Ontario

ROYAL COMMISSION

ON

ELECTRIC POWER PLANNING

CHAIRMAN: ARTHUR PORTER

REPORT ON THE NEED FOR ADDITIONAL BULK POWER FACILITIES IN SOUTHWESTERN ONTARIO

ROYAL COMMISSION

ON

ELECTRIC POWER PLANNING

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8 June 1979

The Honourable James A.C. Auld
Minister of Energy
56 Wellesley Street West
12th Floor
TORONTO, Ontario

Dear Mr. Minister:

Pursuant to Order-in-Council #2065/78 dated 12 July 1978 requesting the Commission to report on the need for additional bulk power facilities in S.W. Ontario, and the Commission having completed these duties, I have pleasure in submitting herewith the said report.

Yours very truly,

Arthur Porter
Chairman

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N O T E S

REPORT ON THE NEED FOR ADDITIONAL BULK POWER FACILITIES IN SW ONTARIO

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I - INTRODUCTION

During March 1979, the Royal Commission on Electric Power Planning conducted 23 sessions of public hearings in municipalities and townships in southwestern Ontario - London, Kitchener, Wingham, Chatham, and Sarnia - to consider the need, if any, for additional bulk electric power facilities in the region. The relevant paragraph in Order-in-Council No. 2065/78 reads:

> For the geographic area of Ontario south of Bruce nuclear power development and west of a line between Essa transformer station and Nanticoke generating station, consider and report to the Minister of Energy on or before May 31, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing and committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of interconnections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their locational and environmental aspects;

To ensure that this component of the Commission's inquiry can be put into the perspective of the whole, we have included in Appendix A the Commission's Terms of Reference as well as other Orders-in-Council that relate specifically to the inquiry.

This report presents our findings and recommendations relating to the above. It is important to note in reading it, however, that, prior to the holding of the hearings mentioned above, the Commission held certain reservations concerning the adequacy of the information and data base that was provided by Ontario Hydro, and at various times considered

postponing the hearings - see Chairman's Opening Statement, London, March 6, 1979, and Mr. Bruce Campbell's Response, at Appendix B. In particular, the Commission's questioning of the adequacy of information relates specifically to the data base upon which the forecasted loads for the SW Ontario region are predicated; this topic is considered in Section V.

Although an earlier reporting date (on or before May 31, 1979) [1] is required than for the Commission's Final Report (on or before October 31, 1979), the present report should be read in conjunction with the Final Report. Indeed, it cannot be over-emphasized that the concepts underpinning electric power planning, consideration of which is our major task, relate to Ontario's electric power system as a whole. The utilization and behaviour, from instant to instant, of major components of the system that are located in a particular region, is inextricably linked with the loads being supplied in the total system. On the other hand, it is meaningful to consider the electric power load in a region, area, or municipality and to attempt to forecast the growth or decline of this load. Further, if sufficient weight can be attached to the forecasted loads, the future dates when additional bulk power facilities will be needed to meet these loads, with adequate levels of reliability, can be assessed. The hearings that we completed recently have added appreciably to our knowledge and understanding of the basic planning concepts that are relevant to the whole power system, and will help materially in the preparation of our Final Report.

Because of the close relationship between the Commission's terms of reference for this specific study and the requirements of The Environmental Assessment Act 1975 (see Appendix A), it is important to explore this relationship and its potential implications. We note, for example, that, Order-in-Council No. 2065/78 states:

> WHEREAS it is desirable to have the Royal Commission on Electric Power Planning review the need for, and the timing of, additional bulk power facilities and to report thereon to the Minister of Energy, and for the specific nature of additional bulk power facilities which might then be proposed, including their locational and environmental aspects, to be reviewed by the Environmental Assessment Board;

While The Environmental Assessment Act requires, under Part II, Section 5, subsection 3:

> (3) An environmental assessment submitted to the Minister pursuant to subsection 1 shall consist of,
> (a) a description of the purpose of the undertaking;
> (b) a description of and a statement of the rationale for,
> (i) the undertaking,
> (ii) the alternative methods of carrying out the undertaking, and
> (iii) the alternatives to the undertaking;

During the SW Ontario regional hearings, representatives of both the Food Land Steering Committee and the Concerned Farmers of the United Townships argued, in effect, that the question of "the need for" as well as the locational and environmental aspects related to additional bulk power facilities in SW Ontario should be dealt with exclusively by the Environmental Assessment Board.

We have concluded, on the basis of the evidence presented during the public hearings, that, since the methodology and the information base upon which future load growth in SW Ontario has been predicated

are inadequate, it is not possible for us to recommend, at this time, that the planning of any new facilities should proceed. Such a step would have to depend upon the carrying out of further studies that will be identified subsequently in this report.

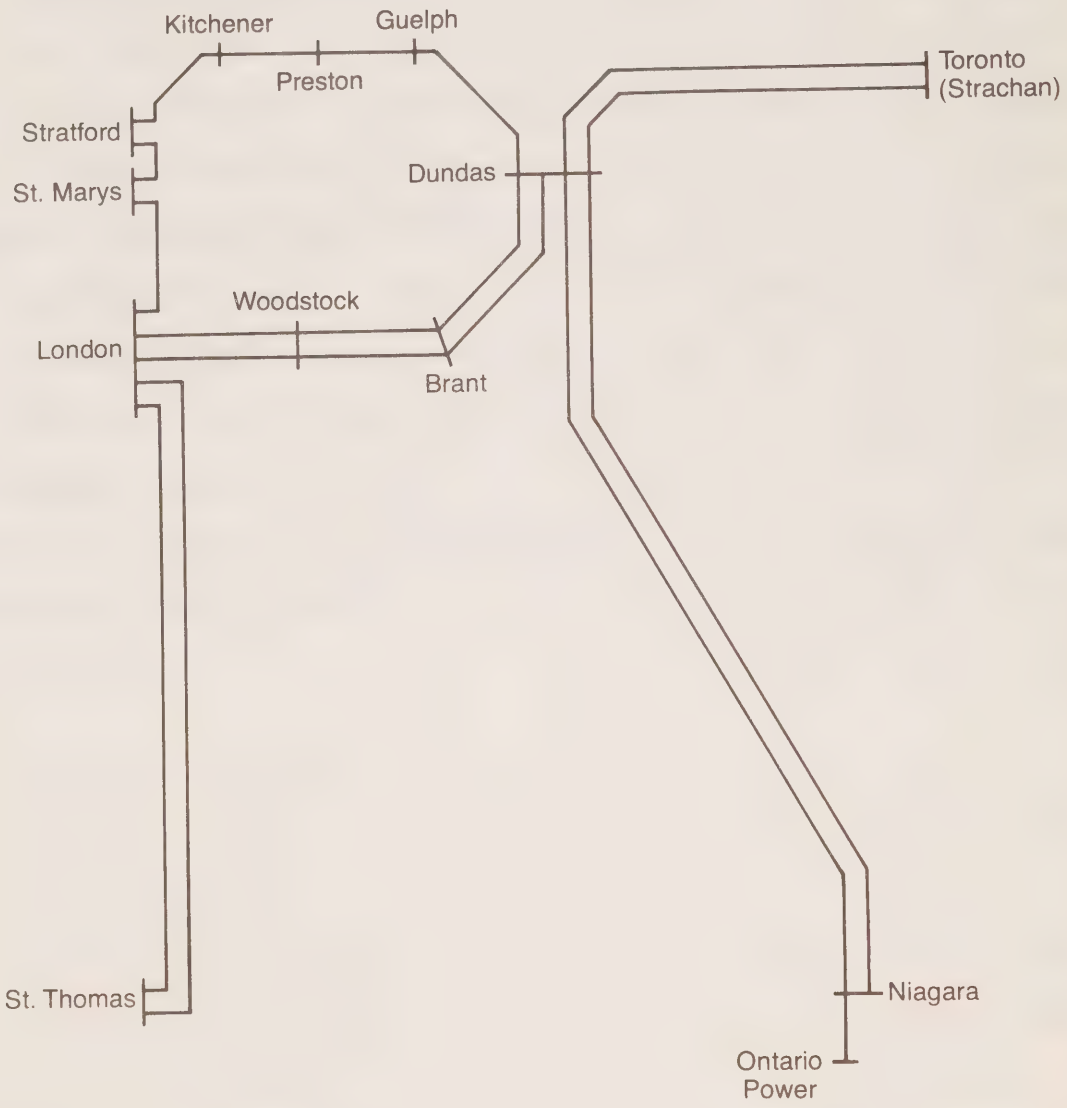
Details of the public hearings, together with a list of participating organizations, institutions, public interest groups, and individuals are given in Appendix C. We are especially grateful for the significant contributions of Ontario Hydro (Counsel Bruce Campbell and various panels of experts); the public utility commissions; and the Food Land Steering Committee (especially Chairman Lloyd Moore and members Elbert van Donkersgoed, Patrick Daunt, and Dr. Howard Patterson). We acknowledge also the submissions by, and the participation of, several industries, chambers of commerce, a trade union council, and several individual citizens.

II - HISTORICAL NOTES

Early in the present century, the very limited electricity supply in SW Ontario was based on small electricity generating stations, for the most part hydraulic but some coal-fired, many of which were municipally owned and operated. Noting the success of the early hydroelectric project based on Niagara Falls, the municipalities decided that the creation of a public agency to handle electric power generation, transmission, and distribution was an obvious step. In consequence, with the enthusiastic support of Sir Adam Beck, the Hydro Electric Power Commission of Ontario was created in 1906. There is little doubt that, not least because of the availability of cheap and plentiful hydroelectric power from Niagara, which replaced the comparatively expensive power from the original small-scale generating plants, this was a highly desirable development.

The early bulk power transmission lines operated at a voltage of 115 kV and a frequency of 25 Hz. Power was delivered to Kitchener in 1910, and by the end of 1911 such municipalities as Guelph, Woodstock, Waterloo, London, Stratford, Hamilton, and Dundas were hooked into the system. Shortly thereafter many more municipalities were added; the two largest in SW Ontario being Windsor in 1914 and Sarnia in 1916. The spectacular growth of the system between 1911 and 1932 is illustrated in Figs. 2.1 and 2.2 - note that 230 kV transmission was introduced during the 1920s. The corresponding growth of the load (only estimates are available until 1954) is shown in Fig. 2.3. The rural electrification

Hydro Electric Power Commission of Ontario
115 kV 25 Hz system – 1911



Source: Ontario Hydro

FIGURE 2.1

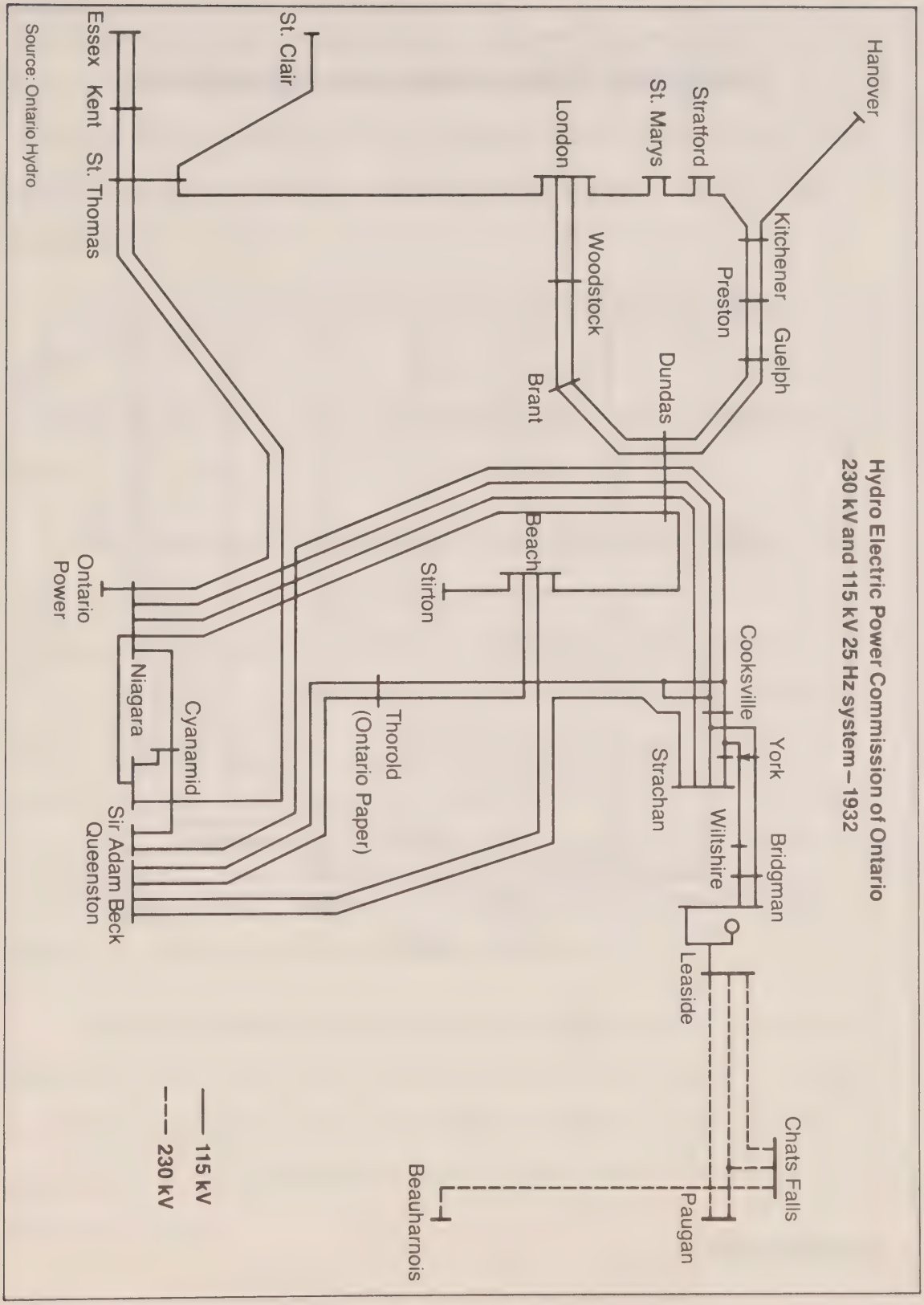
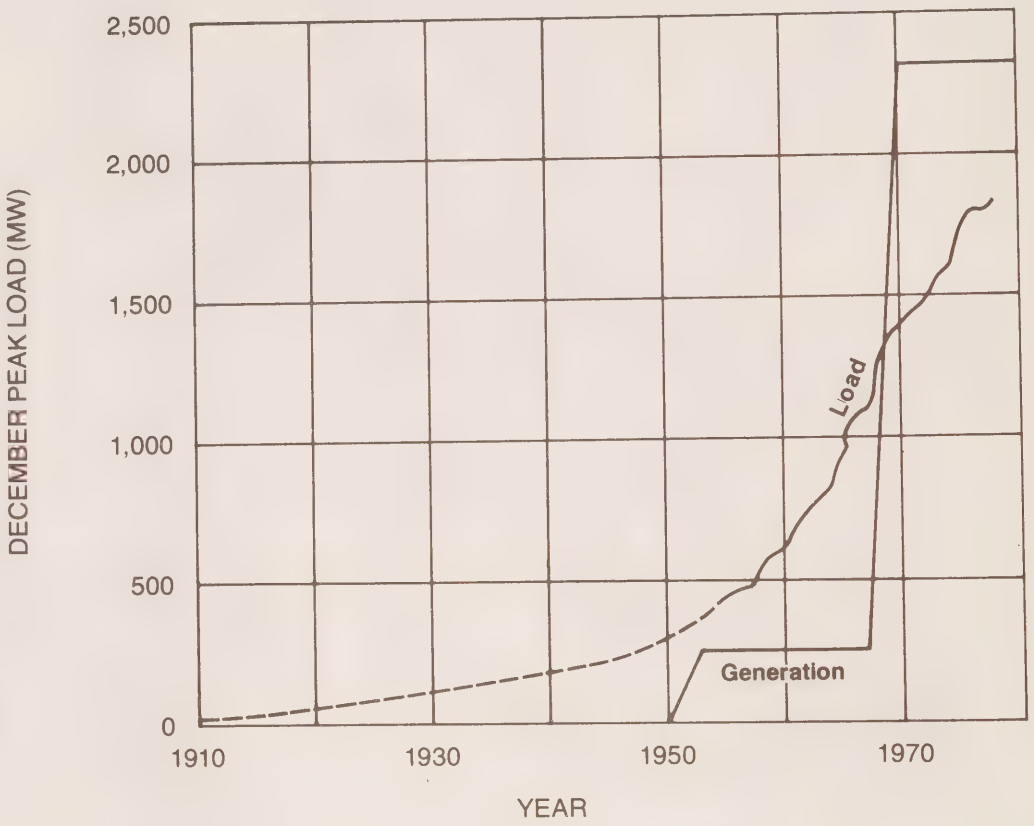

Hydro Electric Power Commission of Ontario
230 kV and 115 kV 25 Hz system – 1932
Hanover
Kitchener
Guelph
Preston
Stratford
St. Marys
Dundas
London
Woodstock
Brant
St. Clair
Essex
Kent
St. Thomas
Beach
Stirton
Ontario Power
Niagara
Cyanamid
Thorold (Ontario Paper)
Sir Adam Beck
Queenston
Cooksville
York
Bridgman
Wiltshire
Strachan
Leaside
Chats Falls
Paugan
Beauharnois
115 kV
230 kV
Source: Ontario Hydro

FIGURE 2.2

Ontario Hydro Western Region loads and generation



Source: Ontaro Hydro

FIGURE 2.3

programme, launched during the 1920s, together with a rapid increase in the number of municipal customers, assured the availability by the late 1930s of a reliable and cheap electricity supply for the majority of residents of SW Ontario. The landmark events in the evolution of Ontario Hydro, with special reference to SW Ontario, are given in Appendix D.

The limits to the capability of a 115 kV bulk power network were reached in the late 1940s and, during the 1950s, a 230 kV transmission network was put into place. For example, the first 230 kV supply into the area was built in 1950 from Des Joachims to London.

The urgent need for new generating capabilities became evident in the early 1950s when, because of the scarcity of new hydroelectric sites and the continued rapidity of load growth, Ontario Hydro embarked on a programme of building coal-fired thermal plants. The first such plants were located in the Toronto and Windsor areas. It has been pointed out that this development constituted a return to the concept of building local generating plants close to the load, but these plants were massive compared with the original small-scale hydroelectric generating plants operated by the municipalities.

Another landmark development in SW Ontario was the development of nuclear power as a joint venture between Atomic Energy of Canada Limited and Ontario Hydro.[1] The Douglas Point site was selected for the utility's first commercial nuclear plant, which was placed in service in 1967.

Further notable developments in bulk power generation facilities in the region were the coal-fired plants at Lambton and Nanticoke, which commenced operation in 1969 and 1972, respectively. Incorporation of these large-scale generating stations necessitated the expansion of the 230 kV network to improve both the supply of power to many areas as well as the reliability of supply to major load centres. The most recent development in SW Ontario in respect to power generation has been the building of the Bruce nuclear power complex, which consists of heavy water plants and CANDU-based generating units. The first unit of Bruce GS A was put in service in 1976.

No introduction to the history of Ontario Hydro, however brief, would be complete without mention of the frequency standardization programme that was undertaken during the period 1948-1959. Initially, the power supply had a frequency of 25 Hz, and this frequency was used to supply nearly all power in SW Ontario and the Toronto-Hamilton area until 1948. However, essentially because the remainder of North America used 60 Hz power, and new types of consumer appliances and machinery were designed for use with 60 Hz, this major standardization programme was undertaken. At present, except for some heavy industry in the Niagara and Hamilton areas, the whole system, in common with all North American utilities, is based on a frequency of 60 Hz.

III - STATEMENT OF THE PROBLEM

The terms of reference relating specifically to the SW Ontario regional hearings, may be conveniently interpreted and expressed as four interrelated problems:

(a) The estimation of electrical load growth in the specified region up to the end of 1987 and from 1987 to the year 2000. Estimates of load growth were included in Ontario Hydro's submission, "Bulk Power Facilities - SW Ontario" (Exhibit SW-4 of the hearings). The problem facing the Commission in this regard is essentially that of assessing the adequacy of the utility's load-forecasting methodology and information base.

(b) If, in the opinion of the Commission, the load growth estimates for SW Ontario provide an acceptable basis for regional bulk power planning, the second problem area is to assess the ability of existing facilities to meet the load projections up to 1987 and between 1987 and the year 2000, taking into account interconnections with neighbouring utilities. It is assumed that the "stop-gap measures"[1] to upgrade (i.e. increase the capacity of) the critical 230 kV circuits (e.g. Middleport T.S. - Buchanan T.S.; Detweiler T.S. - Buchanan T.S.; Detweiler T.S. - Orangeville T.S.; and Middleport T.S. - Detweiler T.S.) by increasing their capacity will be in place in the early 1980s.

(c) On the basis of the answers to (a) and (b) defined above, we are required to determine the resulting date at which additional bulk power facilities, if any, will be needed.

(d) The questions relating to the additional bulk power facilities that will be required to remove power from the Bruce Nuclear Power Development are of central concern. It will be recalled that: [2]

> On November 4, 1975, the Hon. Dennis R. Timbrell, then Minister of Energy, advised that final Cabinet approval had been given "to construct and operate a 4 x 800 MW nuclear fuelled generating station at the Bruce Nuclear Power Development, with a first unit in-service date of 1982, to be followed by two units in 1983 and one in 1984 ..."

Furthermore, according to Ontario Hydro: [3]

> Studies have shown that the existing and approved transmission facilities from the Bruce Nuclear Power Development are inadequate to incorporate Bruce GS B in addition to Bruce GS A and Douglas Point GS. Major new transmission facilities are needed to meet this requirement.

Insofar as the Bruce Nuclear Development question is concerned, the issues requiring resolution may be summarized as follows:

- When will the potential power to be generated at Bruce GS B really be needed? We note that, because there is already an excess of generating capacity located in SW Ontario to supply Ontario Hydro's forecast load in this region to the end of the century, Bruce GS B will be needed essentially to supply the total electric power system.

- If it is assumed that Bruce GS B power will be required before 1987, then, assuming that the stop-gap measures are

in place, what additional transmission facilities will be required?

(e) A final issue concerns the government policy *vis-à-vis* the use of interconnections with neighbouring utilities (Appendix E). What evidence exists to suggest that contracts for the sale of power, on a firm or interruptible basis, say over a period of 5-10 years, can be negotiated?

IV - THE SUBMISSIONS

In this section we present, in the form of direct quotes, the major issues raised in submissions presented to the Commission during the SW Ontario regional hearings. Ontario Hydro's submission, "Bulk Power Facilities S.W. Ontario", December 1978 (entered as Exhibit SW-4) and the associated "Supplementary Information" provided in February 1979 (Exhibit SW-5) were supplemented also by an Ontario Hydro document, "Requirement for Additional Bulk Power Facilities in SW Ontario - Information Relating to the 1979 Load Forecast" (Exhibit SW-6). These documents, in effect, provided the basis for the hearings.

Briefs to the Commission were received from a wide range of interested parties. In each hearing centre, local public utility managers and/or regional operating area managers contributed local perspectives to the load-forecasting function of Ontario Hydro. The agricultural community, primarily represented by the Food Land Steering Committee, played a key role in the cross-examination of briefs. This committee requested, and received from the Commission, public funding to support its participation and the preparation of its brief. Also representing the agricultural community were County Federations of Agriculture, the National Farmers' Union, the Concerned Farmers of the United Townships, and the Turnberry-Howick Hydro Corridor Committee.

Briefs from industry were received from Dow Chemical, Canada Cement Lafarge *(in camera)*, St. Mary's Cement Company *(in camera)*, the

Zorra Gravel Pit Owners & Operators Association, John Labatt Limited, 3M Canada Inc., Union Gas Limited, and the Association of Major Power Consumers in Ontario. A brief was also presented on behalf of the Simcoe and District Labour Council.

Other briefs were received from chambers of commerce, city planners, a hospital, government ministries, and public interest groups (such as CANTDU), as well as from several individual interveners. In all, 41 briefs were submitted and cross-examined in 24 sessions held during 12 days of hearings.

In general, public utility commissions (PUCs), local industries, the Association of Major Power Consumers in Ontario, chambers of commerce, municipal planning departments, and one or two individual interveners supported the contentions of Ontario Hydro with respect to the need for additional bulk power facilities in the region. On the other hand, with one exception, farm organizations, a public interest group, and several individual interveners argued that Ontario Hydro's most recent forecast of load growth in the region is too high, and that the case for additional facilities was not proven. Several submissions strongly supported the concept of energy conservation and a correspondingly lower electric power load growth in the future. The Union Gas submission, while supporting Ontario Hydro's position in general, also provided an indication of the central role natural gas will play in the future energy mix required in SW Ontario.

The load-forecasting process *per se*, and the associated information base, proved to be the issue of most concern to many of the participants in the hearings. This is exemplified by the following quotations:

> The approach I use for the Clinton area is pragmatic rather than scientific. I look back at the actual historical load data and then make a judgement based on actual conditions, trends and expectations in arriving at the forecast.
>
> - Walter J. Palmer
> Area Manager, Clinton Area
> Ontario Hydro

> In establishing five-year demand forecasts for a medium sized utility such as Brantford, reliance is placed on historical growth patterns adjusted to available data relating to current and projected industrial and residential development in the area.
>
> - Brantford PUC

> It cannot be stressed too strongly that our load forecasts are an important by-product of the budget-forecasting procedure employed to determine our future revenue and expenditure requirements. We would continue to forecast future loads for our own purposes in any case.
>
> Weather conditions in a month can influence power demands and obscure the real increase in power demand. For example, in 1978 the degree days of heating for the month of December were below average, increasing the difference between the estimated and actual peaks.
>
> - Guelph Hydro

> It is the opinion of the elected representatives in Sarnia that Ontario Hydro has grossly overestimated power demand in Ontario ...
>
> It is recognized that a multitude of complex factors such as population increases, conservation measures, economic considerations, industrial demand and so on must be taken into account when planning future hydro requirements.
>
> - Mr. Turnbull, Chairman
> Sarnia Hydro

Long project lead-times and the difficulty in accurately predicting growth patterns and business cycles far enough into the future to match them is a problem which industry must continuously face in its own businesses.

- Association of Major
Power Consumers in Ontario

That brings us back to your load forecasting. I think that you should be very sure that you are getting not just extrapolations of past and historical use, but you are looking at the new realities. What is really happening? Is there really industry coming into southwestern Ontario? Are there new houses being built? Are they more energy efficient? Are we selling more appliances? Are people more concerned about energy consumptive devices or electricity consumptive devices? Are they changing their consumptive patterns or their buying patterns?

- David Peterson,
MPP, London Centre

... it is sufficient in context to have left the Council entertaining grave doubts regarding forecasting procedures used by either Ontario Hydro or the Ontario Ministry of Energy.

- R.A. Roubottom, President,
Simcoe & District Labour Council

Ontario Hydro however, has, I believe, been using fairly high forecasts and perhaps have given more weight to future estimates emanating from local utility companies and industrialists than is really warranted.

- W.E. Thomson, Commissioner
of Planning and Development,
Regional Municipality of Waterloo

Our familiarity with the community and the countryside made it impossible for us to believe that Hydro's projections had any possibilities of being realized.

We need to plan for our future electrical needs not just forecast. We need to plan our load growth just as we need to plan our land use.

- Food Land Steering Committee

> The peak demand growth rate has now been determined at 3.7 per cent per year. With an actual growth rate this year that may be as low as 1.5 per cent we feel the 3.7 per cent growth rate more than generous and within the next few years will prove much too high. The saturation point has been reached for hydroelectric growth.
>
> - The Concerned Farmers of the United Townships

> It has become increasingly apparent that long-term forecasting is a meaningless exercise. The only alternative that we can offer is to make the forecasting period shorter and therefore cut down on the errors presently being committed.
>
> - Wellington Federation of Agriculture

> There is no question that these regional estimates are too high. They are not even acceptable to Ontario Hydro. To deal with this by merely subtracting [an unallocated load component estimated by Ontario Hydro] from the totals for the operating areas does nothing to correct the problem, and tells us nothing of the real extent of the error.
>
> - Glen J. Wood
> Kitchener, Ontario

Virtually synonymous with load forecasting is the issue of load growth. How much electricity will be required by residential, farming, industrial, and commercial customers over the next five, 10, and 20 years? This question is central to the SW Ontario regional inquiry. Some of the points raised were:

> From this chart (residential growth in the Niagara region for the year 1977) you will note that Brantford experienced the largest growth rate in new customer additions of all listed at 4.1 per cent year end over year end.
>
> Another development expected to influence area growth is resumption of the 403 Highway construction between Ancaster and the 401 at Woodstock. Completion of this major arterial roadway is expected to have a significant impact on Brantford industrial growth.
>
> - Brantford PUC

Ontario Hydro has from time to time conducted polls of our members regarding their future electrical needs and we understand that this data is incorporated into their current thinking. An over-all industrial growth rate of 4 per cent in SW Ontario appears reasonable.

- Association of Major Power Consumers in Ontario (AMPCO)

Dow Sarnia's growth in electric demand over the next five years is predicted at approximately 3 per cent increase each year.

We support Ontario Hydro in its plans for future bulk power facilities in SW Ontario.

- Dow Chemical of Canada Ltd. Sarnia Division

In line with future existing industrial growth is linked the requirement for Ontario to attract new industrial establishments. As trade unionists and employees we are concerned deeply with the ability of Ontario to fulfill this obligation if levels of hydro production are not maintained at a level that allows the availability of power supply to be a selling or influencing factor to persuade potential investors to locate here.

- R.A. Roubottom, President, Simcoe & District Labour Council

To fully establish load growth Ontario Hydro must take into account the impact of additional electrical facilities on the environment. Load growth is not assessable without relating it to growth in food needs, water requirements, etc. It is our view that acceptable advice on load growth is not possible on the basis of the kind of information so far provided by Ontario Hydro.

In our minds any assessment by our communities of their electrical load growth must be balanced with other growing community needs, especially the need for food and food lands.

- Food Land Steering Committee

We are doubtful that farm energy use will increase at the rates that Hydro seems to suggest. While it is true that electricity does much valuable work on the farm the process of replacing human labour with electric motors has been largely completed. That market is nearly saturated and farmers are becoming more energy conscious in their choices.

- Huron County Federation of Agriculture

We respectfully submit that NO MORE FOOD LAND should be sacrificed for the generation of surplus energy. Serious consideration should be given to the ever-increasing viability of alternative sources of energy such as solar, wind and methane as conventional sources increase in cost.

- Turnberry-Howick Hydro Corridor Committee

It is our opinion that the forecasted growth for Kent County can only occur if agriculturally zoned land is pulled out of production and allowed to develop in an uncontrolled manner.

- Kent Federation of Agriculture

The past few years, however, have seen little in the way of major change. The revolution on the farm, where electric and hydraulic power replaced the man and diesel power replaced the horse, has entered another phase. Past designs are now being updated, made more efficient, because there are few areas left on the farm that have not already benefitted from electric, hydraulic or diesel power.

- Middlesex County Federation of Agriculture

However, I do not find fault with Hydro for its difficulties with forecasting. I do not think that any other people or groups could have prepared forecasts that were more accurate. I don't think that Hydro had any ulterior motive for making other than the most realistic and accurate predictions possible.

- Professor E.J. Farkas University of Waterloo

Especially in 1979, with more and more attention being devoted to future energy supplies, the optimum utilization of energy is a major societal goal. It is not surprising, therefore, that several submissions focussed on the urgent need for energy conservation and effective electric load management. Moreover, and not unexpectedly, the potential role of several alternative sources of energy, as replacements for electric energy, was raised in several submissions:

> We have endeavoured through publicity to approach conservation and we have participated in various seminars for industry.
>
> - John Rousom, Woodstock PUC (Transcript 256, p. 40,312)

> As early as 1974, the Clinton area staff were seeing signs of conservation in their contacts with customers. Conservation began to significantly impact on growth, particularly because of the rate increase in 1977.
>
> - W.J. Palmer, Manager Clinton Area, Ontario Hydro

> In preparation for coming here today, I talked to some of the people, some of the major power consumers in the city, Mr. Chairman. And one, who I won't name ... told me that he cut his energy bill $90,000 last year because of an efficient and new energy management programme.
>
> - David Peterson MPP, London Centre

> During the five years that the Task Force (Energy Conservation Task Force) has been active we have been successful in reducing our electrical energy consumption for 1978 to the 1970 level ...
>
> Whereas we do not expect to return to the dramatic pre-1973 growth levels in energy consumption of 7 per cent for electric power ... we do expect increases in the order of 3.5 per cent per year ...
>
> - 3M Canada Inc.

These measures resulted in a considerable reduction in energy consumption between the years 1977 of 27,500,000 kW.h and 1978 of 24,836,000, representing a reduction of 2,664,000 kW.h in a 12-month period, or down 9.7 per cent.

- J.R. Agnew, Manager
  Property Services,
  University Hospital, London

In view of the federal and provincial governments policies on conservation of our primary resources and efficiently managing energy supply, the prospect of substitute gas produced on an efficient basis from primary resources for space heating and other energy loads should not be overlooked as an option in our long-term planning.

- Union Gas Limited

We would stress creative use of existing energy, serious promotion of energy conservation, and careful consideration about future developments of energy for safety and practical reasons.

- CANTDU

As well, a broader approach than that of "energy conservation" is needed. As discussed below, it is important not only to conserve energy in all sectors of a community but also to facilitate development of local energy sources.

- James E. Robinson
  University of Waterloo

The research work uncovered excellent examples of waste of electricity, and the reasons for it. Outdoor lighting at shopping centres was studied. At one shopping centre, lighting levels on the parking lot at night were found to vary from twice the recommended level at the darkest point on the lot, to 95 times the recommended level at the brightest spot.

- Professor E.J. Farkas
  University of Waterloo

> The new generation coming in is being brought up in an energy conservation society and I am sure this new generation will be more conservation conscious than our generation and it will be an automatic part of their way of life as they mature and marry and have families.
>
> In other countries such as Sweden, Norway, Holland, and others, major investments in district heating, giant power windmills, better and more efficient furnaces, combination incineration and district heat producing plants, heat pumps and of course solar heating are in place and growing every day in demand.
>
> - W.E. Thomson, Commissioner of Planning and Development, Regional Municipality of Waterloo

> In addition to these uncertainties are possible changes in government policy in areas such as bulk metering, marginal cost or time-of-day pricing, or changes concerning the encouragement of conservation and renewable energy.
>
> - Glen J. Wood Kitchener, Ontario

The related topics of reliability of supply, transmission planning, and interconnections with neighbouring utilities were considered in some detail during the hearings. For the most part these are highly technical subjects, but some basic concepts emerged. Examples are:

> Any increased system failures and outages will result in production stoppages and inefficiencies in SW Ontario industries that will have serious financial effects.
>
> - Association of Major Power Consumers in Ontario

> Several plants are very sensitive to power outage and their major concern with electric power is consistency of supply. A momentary loss of power immediately stops all production and efficient production is lost for approximately 4-5 hours. In the glass production a momentary loss costs $25,000. An extended power loss could have a serious effect on production for a period of days; also the danger

involved for fire and human lives especially in the blade spring manufacturing of Eaton Yale because of the large amount of oil.

- Wallaceburg Hydroelectric System Commission

The planning should involve knowledgeable provincial groups till it gets down to the local area where public participation will be involved. There is no need now to plan for the year 2000. Certain basic planning must be established to evaluate the impact on the province, on an on-going basis. If planning of impact on agriculture, urban and environment, had been incorporated into "the red book" (Exhibit SW-4) it would have been more acceptable.

- The Concerned Farmers of the United Townships

We objected to the proposal to build such a bulk power grid in SW Ontario. But it appears that our objection has never been fully understood by Ontario Hydro and others. Perhaps they have not wished to understand.

- Food Land Steering Committee

Necessarily there must be uncertainty when projecting needs beyond just a few years. We believe that Ontario Hydro, faced with a variety of growth rate possibilities, must plan to be in a position to supply a healthily growing demand. Implementation of plans can readily be slowed down but acceleration can be extremely costly if possible at all.

- Association of Major Power Consumers in Ontario

It is important to note that these interconnections figure prominently in Ontario Hydro's investigations into firm power exports to the United States. It is not clear whether any market exists for such exports. Present indications are that they do not.

- Glen J. Wood
Kitchener, Ontario

Our second concern is in the area of hydro power trade-off contracts with the United States. We understand that agreements exist with two states in particular for Ontario Hydro to supply our excess to these states and to other Canadian provinces during their peak demand periods. .... Also could the present and future importance of oil costs and supplies to the United States have a bearing on America's needs, making our hydroelectric power a viable export?

- R.A. Roubottom, President
Simcoe & District Labour Council

V - THE LOAD FORECAST AND INFORMATION BASE

The load forecast is the basis of electric power planning. Because the basic requirement in the Commission's terms of reference relating to the power needs for SW Ontario is to assess Ontario Hydro's projections for the region to the year 1987, and from 1987 to 2000, a review of the load-forecasting process is essential. It is a particularly important topic at present. Indeed, the Commission's Final Report, and supporting documents, will address the question of the future demand for electricity in Ontario in considerable detail. Accordingly, we will do little more in this section than introduce the load-forecasting methodologies of Ontario Hydro and comment especially on the demand projections for the SW Ontario region included in Ontario Hydro's main submissions (Exhibits SW-4, SW-5, SW-6).

Three generic approaches to load forecasting may be summarized as follows:

(a) the goal-oriented approach - the load forecast is predicated on assumptions about a desired future

(b) the historical trend or "bottom up", approach - the load forecast is based on extrapolation of past detailed records of customer usage

(c) the macro-economic, or "top down", approach - the forecast is predicated on various economic factors, such as trends in per capita gross national (or provincial) product, in employment, in prices of electricity and other forms of energy, etc.

Until comparatively recently, the emphasis has been on (b) and (c). But, clearly, the ever-increasing utilization of electricity, characterized by exponential growth during the period 1925-75 when the average compound growth rate was 6.5 per cent annually, cannot continue indefinitely. We believe, and the rationale for this belief will be presented in the Commission's Final Report, that all three approaches have their place but must be supplemented increasingly by a fourth class of model, not widely employed hitherto, which is based on end-use consumption patterns and saturation analysis. We recognize that major changes in society, not least in social relationships, will be unavoidable. In simple terms, our philosophy for survival, albeit survival with comparatively high living standards, is based essentially on the need to live within environmental constraints, to ensure adequate food supplies, and to optimize our utilization of energy.

The Load-Forecasting Process

Ontario Hydro's current load-forecasting process is predicated essentially on the use of macro-economic models supplemented by the individual load forecasts (over a period of five years and sometimes beyond) supplied by the public utility commissions (PUCs), the regional offices of the utility, and the utility's directly-served industrial customers.

The process is shown in the form of an information flow chart in Fig. 5.1. As described in Ontario Hydro's Load Forecasting Memorandum submitted during the public information hearings in May 1976, the procedure is as follows:

(i) When a new forecast is required (normally once a year), notification is sent by letter [from Ontario Hydro's head office Load Forecasting Unit] to the Regional Offices.

(ii) The Load Forecasting Unit prepares a set of two computer generated forecasts for each municipal and rural area wholesale customer. These are generated by a computerized forecasting model.

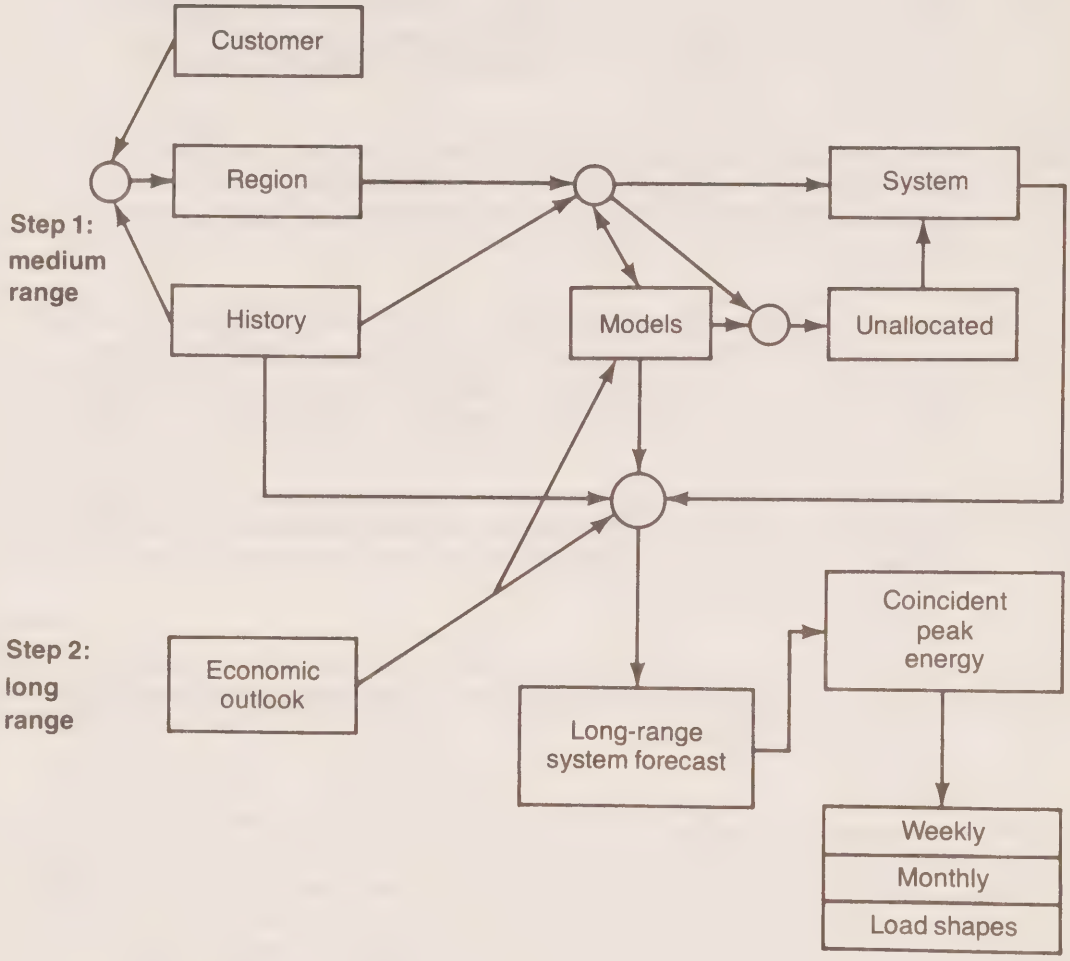
(iii) Regional personnel must reject one of the computer forecasts, but may reject both and prepare their own. The computer forecasts are intended as a guide only. They are particularly helpful in assessing normal seasonal variability in load.

(iv) For direct industrial customers, computer projections are not provided, because the model is not appropriate. Regional personnel compile forecasts for these customers after detailed consultation with them.

(v) When the regional forecasts have been completed, they are sent to the Load Forecasting Unit for assessment and compilation into system totals.

If discrepancies between the regional forecasts and the model-generated forecasts remain after discussions with regional personnel, the forecasts are modified by the Load Forecasting Unit,[1] by the application of a judgemental factor - the "unallocated load". This may be either "positive" or "negative". Notwithstanding the successful application of this methodology to load forecasting during the past 30 years, we have concluded that the load forecast should be predicated increasingly on the development

Small-area, long-range forecasting process



Source: Ontario Hydro Exhibit SW 10

FIGURE 5.1

of key energy growth (and decline) indicators and patterns, such as:

- population growth and increase in specific types of households
- growth patterns in the industrial, commercial, and farming sectors
- the impact of energy conservation and load-management practices
- the contribution of other energy forms such as natural gas, solar, and coal in end uses where these other forms are, or may become alternatives to electricity
- the degree of saturation in the utilization of electrical appliances
- the impact of emerging technologies, e.g. computer control of total energy systems in factories, shopping centres, apartment building complexes, etc.

Note that these factors, especially the future impact of energy conservation in its most far-reaching sense, will be considered in the Final Report.

We are conscious of the impossibility of generating accurate predictions of long-term electric power requirements, but we agree with the conclusions of the Select Committee on Hydro Affairs who,

in 1976, recommended that:

> Ontario Hydro develop an econometric forecasting model that will account for all quantifiable variables that can be anticipated to have a significant impact on the future demand for electric power.[2]

We have noted, also, support for the Select Committee position in a recent "opinion" with respect to long-range electric power planning, in which the State of New York Public Service Commission, in Opinion No. 78.3 issued on March 6, 1978, concluded:

> The load forecasts in this case necessarily involve varying degrees of uncertainty. And is has never been our purpose to engage in a quixotic process of seeking the "perfect" method for predicting the future. But we do want to have developed a forecasting methodology that can properly and promptly take into account relevant, new information as it becomes available. To the extent that this kind of forecasting methodology permits the explicit consideration of a wide variety of underlying determinants of electric demands, we will be better able to relate changes in socio-economic trends to the need for new electric capacity.

The Information Base

Referring to Fig. 5.1, we note that the quantitative basis for the medium-range forecast is provided by the customers, on the one hand, and by historical trends, on the other. An additional primary input, albeit qualitative, for the long-range forecast is the "economic outlook".

In Ontario Hydro's submission, "Bulk Power Facilities SW Ontario - Supplementary Information" (Exhibit SW-5), the centrality of customer

input is stressed:

> However, the load forecasting methodology used by Ontario Hydro does rely heavily on estimates of load growth provided by Hydro's wholesale customers (municipal utilities), by direct industrial customers, and by Ontario Hydro's regional offices (for retail areas serviced directly by Ontario Hydro).

During the hearings, we examined a total of 15 PUC submissions and came to the following conclusions:

- Taken by and large, the PUCs concentrate on a one-year forecast, which they require for facilities planning and for financial and budgeting purposes. They provide also a more speculative five-year forecast and in the case of some PUCs a linear extrapolation beyond five years.

- The load forecasting process is, justifiably, not one of the major time-consuming tasks undertaken by a PUC; several managers indicated that the actual process of preparing the annual load forecast occupies only a few days. (It is recognized that the manager brings to this task a year-long process of familiarizing himself with new load developments in his service area.)

- A majority of the PUCs that presented briefs used linear extrapolation of the load to provide the five-year forecast. Indeed, only in two cases was there evidence of exponential extrapolation. It is important to note that "linear growth" corresponds to a decreasing rate of growth per annum.

- Our impression is that the communication links between the PUCs and the Ontario Hydro regional offices could be strengthened. For example, several PUC managers were surprised to learn during the hearings about the judgemental adjustment to the load forecasts (i.e. the "unallocated load") introduced by Ontario Hydro. Our overall conclusion is that the PUC's load forecasts as conducted at present, are of principal benefit to Ontario Hydro's short-term facilities planning programme. It would appear that their contribution to Hydro's medium- and long-term forecasting process is of marginal significance.

As with the PUCs, Ontario Hydro requests its direct industrial customers to prepare annual load forecasts. Becuase there was understandable reluctance on the part of some such customers to testify in open hearings as to their specific load forecasts, we undertook a confidential staff survey of these customers. Our principal findings are:

- The industrial customer's load forecast is usually prepared by the utility's procurement manager or the plant manager. Preparation of the forecast usually involves several hours to several days of intermittent work each year.
- The methods used are essentially "facilities based".
- The historical load of the past few years provide the starting point. These loads are related to facilities in place as well as production levels and are adjusted to reflect anticipated changes in facilities, production levels, and the effects of energy

conservation programmes.

- Estimated production levels two or more years into the future are usually based on sales forecasts. However, because most firms do not have sales forecasts for six years into the future, the load forecasts beyond this period are simply trend extrapolations.

- Many of the direct industrial customers have energy-conservation efforts under way. But because electrical energy is usually a small part of the total energy demand, conservation efforts in this area are quite limited, but there are significant exceptions.

- The electrical load forecast is often an input to a firm's internal budgeting process. Although some firms admitted that it is preferable to be under rather than over budget, they stressed that the load forecast is as impartial as possible.

- Several of the firms surveyed indicated that Ontario Hydro reviewed their forecasts with them. These reviews occurred occasionally for some firms and almost annually for others. Several other firms indicated that their forecasts have never been challenged by Ontario Hydro. The frequency of the review appears to be roughly correlated with the magnitude of the changes in the electrical load forecast by the firm.

The role of the Ontario Hydro regional offices in the load-forecasting process is essentially one of aggregation of data, except for some of the

smaller PUCs, where the regional offices actually prepare the forecasts. These offices obtain the load forecasts of the PUCs in their regions, incorporate the load forecasts for the Ontario Hydro area customers, i.e. residential, farm, commercial, and industrial customers outside the service areas of the PUCs, and transmit the aggregated information to Ontario Hydro's head office. As in the case of the PUCs, it is unclear how much time and effort is involved in the forecasting process at the area regional levels, not least because of the many other responsibilities of these offices in ensuring smooth operation of the electric power system. If, as we recommend, more emphasis is placed in the future on forecasts predicated on end-use, the area and regional offices will begin to play a more significant role. This is already envisaged by Ontario Hydro, and we understand that the first regional conference on load forecasting was to take place in May 1979.

The SW Ontario Load Forecast

Exhibit SW-4, "Bulk Power Facilities in SW Ontario", includes the customer non-coincident December peak load forecasts (municipal, retail, and direct industrial) for the period 1978-2000. These occupy 16 pages of the submission - they are supplemented by forecasts of what Ontario Hydro termed its critical-area transformer station and direct industrial loads, coincident with January peaks. It has proved impossible for the Commission to accept this mass of data at face value. For example, in a letter to Ontario Hydro dated October 25, 1978, the Commission expressed the hope

that the utility's submission with respect to the SW Ontario regional hearings would provide in-depth information on the following factors:

- population growth
- housing starts
- electrical energy needs of industry and agriculture, especially those of new industries
- additional electrical energy needs of the commercial sector.

In effect, we anticipated a more "end-use"-oriented load forecast. However, Ontario Hydro explained that they do not base their forecasts on these data and do not have the information we sought. We also expected that more information would be available relating to the future impact of energy conservation, load management, and the degree of competition between electricity and other fuels in SW Ontario energy markets.

Although it was stated during the hearings that the impact of energy conservation on load growth has been taken into account in developing the load projections for the region, we are not satisfied that the present procedure accounts fully for the potential impact of conservation. In Exhibit SW-6, p.7, Hydro's load forecaster writes:

> It is assumed that conservation activities are fully captured in the response to price used in these calculations [the load forecasting model]. That is to say, the price elasticity is a best estimate, and it is assumed that consumers will adjust their demand and life-styles to incorporate an optimum amount of conservation.

We note, for example, in Ontario Hydro's memorandum, "Load Forecasting", that for the system as a whole it was assumed there would be a reduction of 831 MW (corresponding to 12.3 million MW.h) for 1981-85 as a direct

result of electric energy conservation. The evidence for this is obscure. We feel intuitively that the reductions in peak load, and in electric energy, resulting from conservation may well increase exponentially for several years and linearly thereafter.

There is clearly an urgent need to monitor the impact of conservation and to establish basic patterns that relate to conservation achievements in specific applications. The very encouraging results achieved through conservation programmes in schools, colleges, universities, and hospitals should provide one information base; another would be provided by monitoring conservation results in the industrial sector and yet another by doing the same in the commercial sector. Ontario Hydro is, of course, well aware of the importance of undertaking such in-depth analyses. For example, in the utility's memorandum, "Energy Utilization and the Role of Electricity", April 1976, page 6.4-1 in reference to energy conservation, it is stated that:

> An issue of prime importance is the determination of energy (kilowatt hours) and demand (kilowatts) goals for reduction. This involves detailed analytical work presently underway in assessing potential energy reductions by classes of customers, type of use, system characteristics, and identification of the best opportunities for reduction. The effect of price level and structure on the level of utilization is being analyzed, and the relative importance of kWh and kW reductions is to be assessed in order to determine the direction and nature of the efforts to be taken.

This programme has now been under way for more than three years, and we hope the original objectives have been achieved. To date, however,

we have not received any detailed information relating to the status of these studies.

Like energy conservation, load management will have in increasingly important impact on peak power requirements. In this regard, we have noted the innovative programmes being developed by Ontario Hydro in conjunction with the Scarborough and Oshawa PUCs, in which both AM radio signals and the Bell network are being used to monitor the consumption of utility services and to control customer loads such as water and space heating. The potential gains to be expected in the future do not appear to have been reflected in the load forecasts. During the hearings, moreover, we did not receive much information on the load-management programmes that Ontario Hydro referred to three years ago, as follows:

> In addition programmes for load management are being developed and will become an integral part of future Load Plans.[3]

The Residential Sector - An End-Use Example

To exemplify the need for more emphasis on an end-use approach to load-forecasting, it is appropriate to consider the residential sector and especially space and water heating. There were many references to this area during the hearings. However, the information at present available is not very helpful from a load-forecasting standpoint. Note, for instance, the evidence provided by two major PUCs. First, the manager of the Woodstock PUC stated:

> We note that there are decreases and almost zero growth during summer months but there is a significant increase during the last three months. It is difficult to explain this increase but we suspect that it is the result of the addition of a considerable number of electrically heated dwellings...

The submission by the Brantford PUC presented a different picture:

> One area of residential activity, space heating, and water heating has experienced a severe reduction in electrical load growth that has resulted from the impact of electrical utility withdrawal from virtually all marketing activities. Rightly or wrongly, the emphasis of Hydro's conservation programme has been perceived by the public as one of "no use" rather than "wise use" of electricity insofar as it relates to electric home heating.

Apparently, the increasing use of natural gas for residential space and water heating is having a negative impact on the use of electricity for these purposes in the Brantford area. We noted, for example, this contention by Union Gas Limited:

> In the residential market Union Gas is currently capturing in excess of 80 per cent of the new construction of single-family homes throughout the franchise area where distribution service is available. This includes the detached houses, semi-detached houses, duplexes, and row housing. This rate of capture is expected to continue for the foreseeable future. The stated Government of Canada policy to encourage market development for natural gas should help this rate of penetration.

The only specific reference to future load growth resulting from space heating in the residential sector appears in Exhibit SW-4, Appendix C, in connection with the Stanford Research Institute International - Canadian Electrical Association (SRI-CEA) model load projections.[4] On

the basis of the second scenario (intermediate between the low and high scenarios), the actual electrical energy demand for residential space heating for SW Ontario in 1976 was 1,055 GW.h, while the forecast electric energy consumption in this category for 1985 is 2,605 GW.h, and for the year 2000 it is 4,910 GW.h. Such a four-fold increase in residential electric space heating is not consistent with the evidence provided by Union Gas Limited and other witnesses.

Further, similar rates of growth are forecast for the residential electrical appliance loads. In the light of the high degree of appliance saturation (except for air conditioning, which admittedly is an important potential load in SW Ontario) and the increasing efficiency of appliances, and taking energy conservation into account, there appears to be no reason why electricity consumption in this end-use should increase by a factor of three between 1976 and the year 2000 - especially bearing in mind the fact that neither population nor the number of households in the region are likely to increase by more than 40 per cent. In fairness Ontario Hydro stated that it did not rely on the SRI-CEA model results in developing their forecast of SW region load growth.

Note on the Agricultural Sector

In the agricultural sector, there are also differences of opinion relating to load growth. For example, the submission by the Manager, Clinton area, Ontario Hydro, indicates that the average annual consumption of electric energy by farm customers in the area increased, during the

period 1968-78, at a compounded annual rate of approximately 6.5 per cent and that this consumption rate shows no sign of diminishing. However, it was suggested that this might have been due at least in part to the consolidation of smaller farms into larger farms. And members of the Turnberry-Howick Hydro Corridor Committee reiterated that "future farm electrical consumption trends will be lower due to the economics of changing farm practices...". This conclusion was re-emphasized by both the Middlesex County Federation of Agriculture and the Food Land Steering Committee. The former stated:

> Further development of alternate sources of energy will moderate increases in electric power consumption. Electric power usage, as we have shown, has already reached a saturation point on the farm.

Ontario Hydro's End-Use Research

There is encouraging evidence that Ontario Hydro is already approaching the load-forecasting problem from an electric energy end-use standpoint. In particular, the utility is undertaking more experimentation with the SRI-CEA Econometric model. However, because the model is of comparatively recent origin, Ontario Hydro has had limited experience with its use.

Additional activities related to end-use forecasting are described in the Ontario Hydro submission to the Select Committee on Hydro Affairs, February 28, 1979, "Status of Actions relating to the 1976 Select Committee Recommendation III-I". With reference to the annual demand

for electricity in the residential sector, this submission stated:

> Ontario Hydro and Statistics Canada are currently co-operating to produce a new data set of cross-sectional household information for Ontario in 1976. This data set will contain two years of information on: household annual electricity usage, average and marginal prices for electricity, gas and oil, and heating degree days. The resulting residential models should provide a definitive econometric representation of electricity demand in this market sector for Ontario.

With reference to the industrial sector it stated:

> The Ontario Hydro Industrial Model is currently being developed. The data base for this model contains electricity demands at 15-minute intervals for 60 industrial firms served by Ontario Hydro January 1970 through December 1977. The model is being developed on monthly consumption, which conforms with the billing period. Not only energy, but peak demand and load factor are being investigated.

With reference to the commercial sector it stated:

> ...considerable information on the commercial sector is being collected by load surveys and by the Conservation Division. For modelling purposes, however, the data is insufficient...

While the above studies, supplemented by continuing development of the SRI-CEA econometric model, indicate that Ontario Hydro is now paying serious attention to the end-use approach to load-forecasting, it should be noted that the actual impact on future load forecasts may not be observable before 1981. In the meantime, we urge that future load forecasts should also take into account, and should report specifically on, the impact of:

- energy conservation techniques, especially insulation, double glazing, thermal shutters, etc.
- solar space and water heating

- dual-purpose generation systems (thermal and electric power co-generation, district heating, etc.)
- the implications of "total energy systems"
- the utilization of alternate energy systems on the farm (e.g. solar corn-drying, etc.)
- the trends in the market share of electricity versus oil, gas, and coal.

The Commission's Conclusions

We have concluded that the load forecasts provided by Ontario Hydro for the SW Ontario region are unacceptable as a basis on which to establish the need for, and the timing of, additional bulk power facilities in the region. We draw attention, for example, to our as yet unpublished studies relating to the future demand for electricity in Ontario.[5] On the basis of these, we anticipate lower load growth rates than those contained in Ontario Hydro's 1979 Load Forecast. Accordingly, we are of the opinion, concerning the question of the need for additional bulk power facilities in SW Ontario, that a breathing space is available during which urgently required studies relating to the load forecast can be continued and accelerated, in particular:

- studies in close collaboration with the Ontario Ministry of Treasury and Economics of population growth, employment patterns, and income and product in all sectors of Ontario's economy, to provide a firmer basis for the load forecast

- experimentation and application of the SRI-CEA model and variations
- the development of means of monitoring patterns of energy conservation
- the analysis of end-use patterns, taking into account the impact of alternate energy sources and technologies, e.g. natural gas for space heating, solar space and water heating, etc.
- studies of the impact of the price of energy on the demand for electricity [6]

The above-mentioned studies should provide a key component of the rationale upon which the assessment of the need for additional bulk power facilities in SW Ontario should be based.

VI - BULK POWER FACILITIES - SW ONTARIO

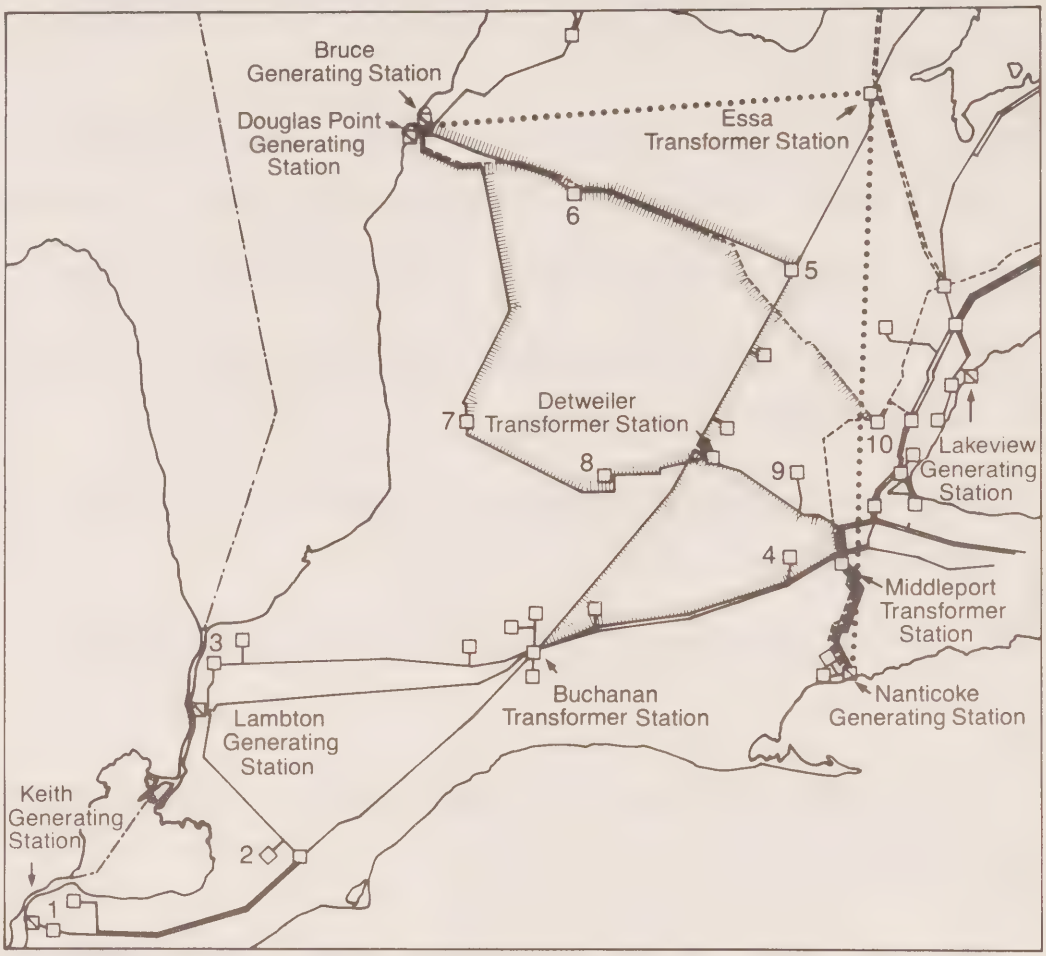
Ontario Hydro's bulk power facilities include the following major components:

- generating stations, e.g. hydraulic, fossil-fuelled, nuclear, gas turbine, (see Table 6.1 for facilities located in SW Ontario)
- high-voltage transmission lines (500 kV, 230 kV, and 115 kV)
- transformer stations that convert bulk power from one voltage level to other voltage levels
- bulk power switching systems for the control and protection of the power system
- a central computer-based control station (i.e. the Richview Control Centre)

The location of the major bulk power facilites in SW Ontario is shown schematically in Fig. 6.1.

The peak capacity of the generating stations in the region under study (10,069 MW excluding Bruce B and 13,149 MW including Bruce B, as indicated in Table 6.1) will provide excess generating capacity appreciably above the required 25 per cent reserve margin up to 1987 and beyond, even on the basis of Ontario Hydro's 1979 Load Forecast, which is in the order of 5,200 MW in 1987 and 9,500 MW in 2000 for the region. It is evident, therefore, that the need, if any, for additional bulk power facilities in the future relates essentially to the transmission

Ontario Hydro bulk power facilities in southwestern Ontario



- Transformer station
- Nuclear generating station
- Fossil-fuel generating station
- 230 kV transmission line
- 500 kV transmission line
- Study area boundary

Critical lines

Transformer Stations

1. Malden
2. Kent
3. Sarnia-Scott
4. Brantford
5. Orangeville
6. Hanover
7. Seaforth
8. Stratford
9. Galt
10. Milton

Source: Ontario Hydro

FIGURE 6.1

system and the associated transformer stations. We address this problem in Sections VIII and IX after introducing the concept of reliability in the next section.

TABLE 6.1 - Installed and Committed Generation Facilities within SW Ontario Study Area

	Installation date	Peak capacity
Hydraulic		
Eugenia	1915-1920	3.5 MW
Nuclear		
Douglas Point	1967	206 MW
Bruce A	1976-1978	2,960 MW
Bruce B	1983-1987	3,024 MW
Coal		
J.C. Keith *	1951-1953	256 MW
Lambton	1969-1970	2,100 MW
Nanticoke	1972-1978	4,248 MW
Oil-combustion turbines		
Lambton	1967	22 MW
J.C. Keith **	1967	7 MW
Sarnia Scott	1965-1966	71 MW
Detweiler	1967	75 MW
Bruce A	1974-1976	56 MW
Nanticoke	1971	22 MW
Bruce HWP	1976	42 MW
Bruce B	1981-1983	56 MW
Aggregate installed peak capacity		10,068.5MW
Aggregate committed peak capacity		13,148.5MW

* unavailable until June 1, 1980

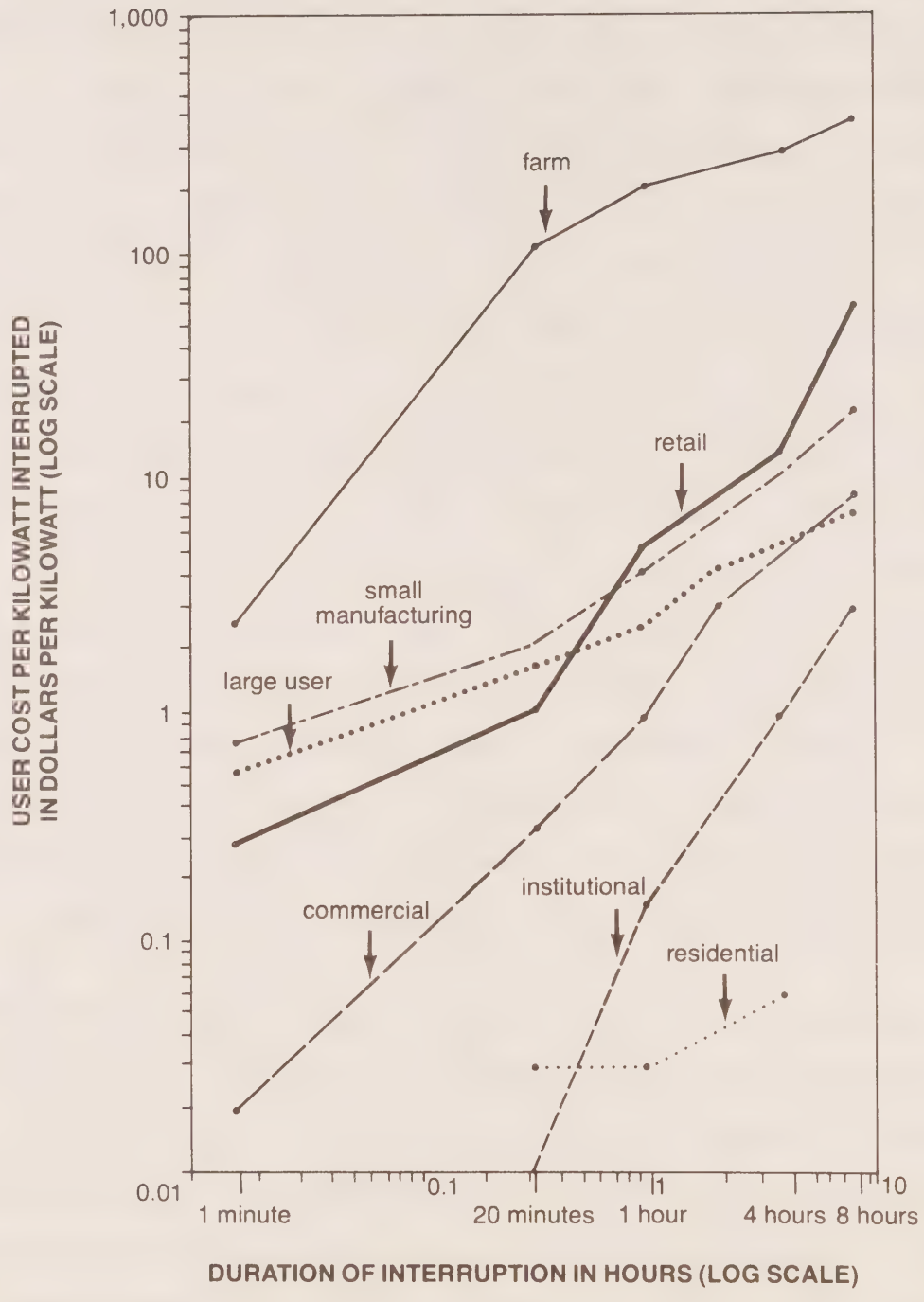
** temporarily unavailable

SOURCE: Ontario Hydro Exhibit SW-5 and Ontario Hydro Power Resources Report No. 790201, February 1979

VII - NOTES ON RELIABILITY

The reliability of an electric power system may be simply defined as the system's ability to meet the demand for power while maintaining frequency and voltage levels within acceptable limits. However, it is important to note that reliability cannot be stated quantitatively except in terms of probabilities. For example, the most widely used reliability index is referred to as the "loss-of-load probability" (LOLP). In simple terms this is the expected number of events over a specific period (say a year) during which the load on the system may exceed the available generating capacity.[1] Until comparatively recently, Ontario Hydro has planned generation to meet an LOLP of about 1 in 2400 in the month of December. This corresponds to one working day in 10 years (on the basis of 240 working days per year). There are indications that Ontario Hydro has changed the generation reliability target from an LOLP of one day in 10 years to five days in 10 years (see Ontario Hydro's 1979 Review of Generation Expansion Program, March 1979, Section 3.0). We also note that Ontario Hydro has recently developed a new reliability evaluation programme based on the "frequency and duration of outages" method.

The level of reliability of Ontario's electric power system varies from region to region and from community to community. In effect, the reliability of supply to a particular customer, or group of customers, is determined by the location of generating stations, the routing and capacity of bulk power transmission lines and the associated distribution networks, and the location and capacity of transformer stations and



Source: Ontario Hydro

FIGURE 7.1

switching stations. Clearly, moreover, the reliability of an electric power system is in large measure determined by the reserve generating capacity and the hypothetical "excess capability" of the transmission lines (bulk and distribution).

Historically, only a comparatively small proportion of electric power outages have been due to failures in the bulk power system. However, failure of the bulk power system due to the inadequate generating capacity or transmission line breakdowns may lead to large-scale rejection of load on a regional scale, while failure of a component or line in the distribution system would normally give rise to local outages only. Major regional electric power outages generally result from a failure of the power system to respond sufficiently rapidly to sudden major changes in load or line outages caused by hurricanes, lightning, etc. (see Section VIII).

While it is comparatively straightforward to determine the cost of providing electric power, it is much more difficult to assess the economic consequences of interruptions of electric power to specific customers. Customers' perceptions of the cost of an interruption differ widely. In this regard, Ontario Hydro recently carried out a customer survey and published the estimated costs of electric power outages of various durations in respect of selected classes of customers. These are shown in Fig. 7.1. Noteworthy is the tentative conclusion that the agricultural and industrial sectors of Ontario's economy are the ones most sensitive to electric power outages.

VIII - ELEMENTS OF TRANSMISSION PLANNING

The majority of the world's large electric utilities are integrated systems. Ontario's electric power system is no exception. It is predicated essentially on a high-voltage bulk power transmission network.[1] Note particularly that, as Ontario's power system evolved, the voltage of bulk power transmission increased. In the early years of this century, when generation was exclusively hydraulic and close to load centres, a 115 kV bulk power network was adequate to cope with the aggregated power levels. During the 1920s and 1930s, this grid was overlain for economic and reliability reasons with a 230 kV bulk power network. Still more recently, with the growth of the provincial load and with the advent of very large fossil and nuclear generating stations, it has proved increasingly necessary, for economic reasons and to minimize the amount of land required for power corridors, to incorporate 500 kV bulk power lines into the grid.

The technical and economic advantages of an integrated system are:

- It provides greater flexibility in operating the generating stations (e.g. base load, intermediate load, peak load).
- It provides a capability of supplying large fluctuating loads without undesirable frequency and voltage swings.
- For the same amount of reserve capacity, the reliability of the system is enhanced.

- Operating costs for the total system are reduced.
- Capital expenditures are reduced as a result of economies of scale.

This section introduces briefly some of the operational concepts that underpin integrated systems. It is particularly important to note, as implied in the previous section, that the reliability of an integrated power system can be facilitated by introducing an adequate degree of redundancy in the system.[2] In the case of the system's generating capacity, this can be quantified readily in the form of the reserve margin. (This index relates the differential between the total system peak generating capacity and the peak demand.) However, no corresponding index of reserve capacity is available, or indeed practical, in the case of the bulk power transmission system.

Studies of the load-carrying capabilities of the bulk power network, under a wide variety of load conditions and line outage conditions, are undertaken using computer-based analytical techniques. These studies constitute, after the load forecast, the initial step in determining if and when new bulk power facilities are required, as well as their general characteristics. However, in spite of the increasing use of computer modelling in the assessment of system reliability, and in spite of improving power system technology, it is clear that considerable reliance must be placed on the judgement and experience of the system planners and engineers. For example, the capability of a transmission line depends on the voltage levels (which must be maintained within close limits),

the power losses (which must be minimized), the thermal limits, the minimum ground clearance requirements, and the stability requirements and associated protection relays and switches. Noteworthy too is the fact that transmission lines deteriorate if operated at high temperatures, and this sets an ultimate limit on the loading capability; but note that, because the associated thermal time constants are in the order of 10-20 minutes, a line can handle excessive loads of short duration. All these factors must be taken into account to ensure satisfactory levels of reliability.

Power System Stability

Stated simply, power system stability depends upon the maintenance of synchronism between all the synchronous generators in the system, in spite of a range of major and minor disturbances manifested, for instance, in transient disturbances and load variations. If, for example, the system is subjected to a major fault (i.e. loss of a bulk power transmission circuit), the generators on line react within fractions of a second and roughly harmonic variations of the so-called rotor angles result. If these oscillations are gradually damped out - which normally occurs within a few seconds - the system remains stable. On the other hand, if the rotor angle variations continue to increase in amplitude, the system rapidly becomes unstable and synchronism between generators is lost within a few seconds.

To minimize the possibility of such instability, very high-speed response circuits are necessary. Suffice it to add that the study of the transient behaviour of a synchronous generator operating in an electric power system is a highly complex subject. For instance, transient stability depends on both mechanical and electrical properties as well as on the nature of the disturbance that gave rise to the transient in the first place.

During normal operating conditions, the power system is subjected continually to minor disturbances caused by a multiplicity of load changes (e.g. when consumers switch power on and off); these disturbances are handled automatically by the individual generator excitation systems. Furthermore, in normal operating conditions when all generators are operating in synchronism, virtually no power is being transferred from one generator to another - the mechanical output of the steam turbine virtually matches the electrical output of the generator, the speed of which remains constant.

If it proves impossible for the control and regulatory circuits to stabilize the system under certain major disturbances, or if disturbances result in severe overloading of transmission circuits, the only option available is "generation rejection", sometimes accompanied by "load rejection". The latter, as the term implies, would give rise to highly undesirable regional black-outs or brown-outs. Generation rejection, an undesirable step also, is based on a generating unit being tripped

extremely rapidly with concomitant reduction in the power to be transmitted; system stability is thereby facilitated. Until comparatively recently, however, in Ontario's power system, the generation rejection technique was restricted to hydraulic units, which are more rugged than thermal units. But with the growth of the thermal generating component it has become necessary, when the situation demands it, to trip these units as well.

Although the control and regulating systems are designed to withstand massive mechanical and electrical shocks due to generation trips, these have been known to fail, and the consequences can be serious, i.e. mechanical and electrical damage necessitating major maintenance work and a consequent high probability that the unit will be unavailable over extended periods. Generation rejection is undesirable especially in the case of nuclear units, because if the governors do not work perfectly the reactors may "poison out", with consequent heavy economic penalties until they can be brought up to power again. Al Watson, of Ontario Hydro's Power System Operations Division, said that he knew of no utility that included any provision for the rejection of nuclear units in its system planning.

Major advances have been made in control technology and generator design, but, because the bulk power transmission network is the means whereby power is transferred through the system (e.g. from generator to load and from generator to generator), it is the network's security that is

crucial in ensuring the total system's stability. It is essentially for this reason that Ontario Hydro is embarking on a programme of implementing certain stop-gap measures to increase the load-carrying capacity of certain critical circuits. These measures include the restringing of critical transmission lines to provide higher current-carrying capacity, operation of the lines at higher line temperatures (up to 150°C from 90°C at present), and the installation of large amounts of static capacitance.[3] However, it is recognized that the use of such engineering solutions, which push transmission technology to the limits, also give rise to a reduction in system reliability.

Interconnections

Interconnections between Ontario's power system and those of United States utilities are important, not only because they are necessary for the export and import of power to and from the United States but also because they enhance the stability, under certain fault conditions, of Ontario's power system. As a member of the Northeast Power Coordinating Council, Ontario Hydro agrees to conform to basic operating criteria set out by the Council. It is worth noting that, assuming tie lines of sufficiently high capacity backed by adequate generation and bulk transmission capacity, Ontario has more to gain from the standpoints of stability and reliability than have the interconnected United States utilities. This is because Ontario Hydro contributes only about 5 per cent to the total "mechanical inertia" of the aggregated systems.

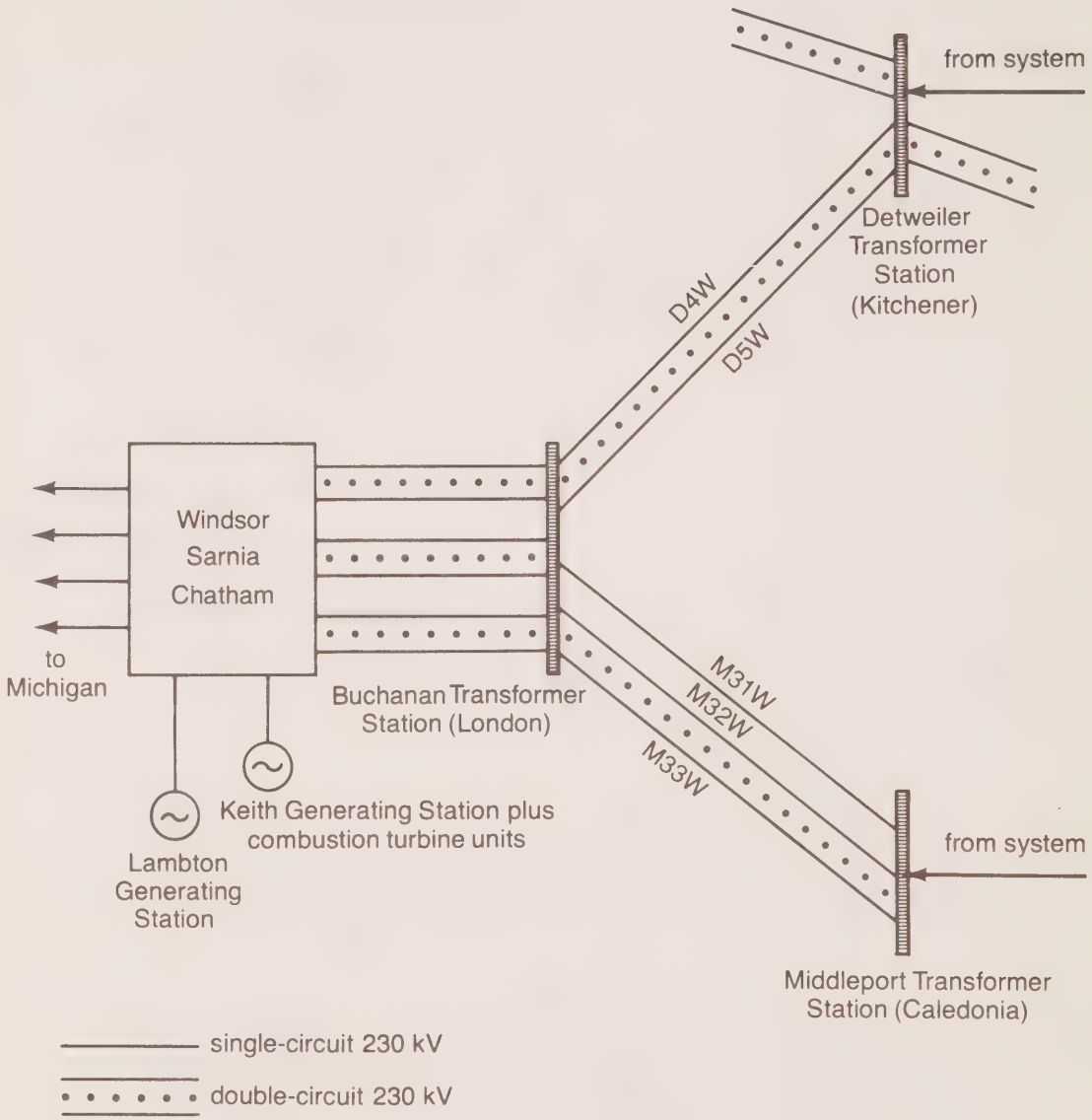
IX - TRANSMISSION PLANNING - SW ONTARIO

Specific problems related to the planning of the bulk power transmission system located in SW Ontario are addressed in this section. The portion of Ontario Hydro's total transmission system that is shown in Fig. 6.1 supplies transformer stations within the region from generating stations situated both inside and outside the region. It incorporates, also, the output of generating stations located within the region to supply transformer stations both inside and outside the region. Further, it allows for the transfer of power to or from the Michigan power system, with which it is interconnected at Windsor and Sarnia. Accordingly, the bulk power transmission system within the SW Ontario region is associated with resources both within its region and elsewhere in the interconnected systems. It handles, in part, the loads within its region as well as elsewhere in the interconnected systems.

During the hearings, special attention was focussed on two major components of this portion of the bulk power transmission system:

- the "London trunk lines" (see Fig. 9.1), comprising in general the 230 kV lines that connect the southwestern load area (Kitchener-Waterloo-London-Windsor-Sarnia and environs) with the "Golden Horseshoe" section (Niagara-Hamilton-Toronto-Oshawa)

Schematic diagram of transmission lines into Buchanan



Source: RCEPP

FIGURE 9.1

▶ the "Bruce connections" (see Fig. 9.2), comprising, in general, the 230 kV and 500 kV lines that connect the Bruce-Douglas Point nuclear power plants with the bulk power system.

Referring to Fig. 9.1, we note that the main transmission system for the southwestern region incorporates one corridor with three 230 kV circuits, which funnels into Buchanan Transformer Station (London) from the direction of Niagara via Middleport T.S. (Caledonia); another corridor comprising two 230 kV circuits, which funnels into Buchanan T.S. from the northeast via Orangeville T.S. and Detweiler T.S. (Kitchener); and six 230 kV circuits that branch out to the west from Buchanan T.S., four of them proceeding due west to Sarnia and two proceeding southwest to Windsor.

Power flows do not split evenly among the five circuits into Buchanan T.S., however. There is some tendency for power from Nanticoke and Niagara to favour the circuits from Middleport and for power from the Bruce and other plants to the northeast to favour the circuits from Detweiler T.S.

Assuming that no power is supplied by the Keith and Lambton Generating Stations, it will be noted that:

(a) The power supply to loads in the London-Windsor-Sarnia triangle, and power exported to Michigan, must all be funnelled into Buchanan T.S.

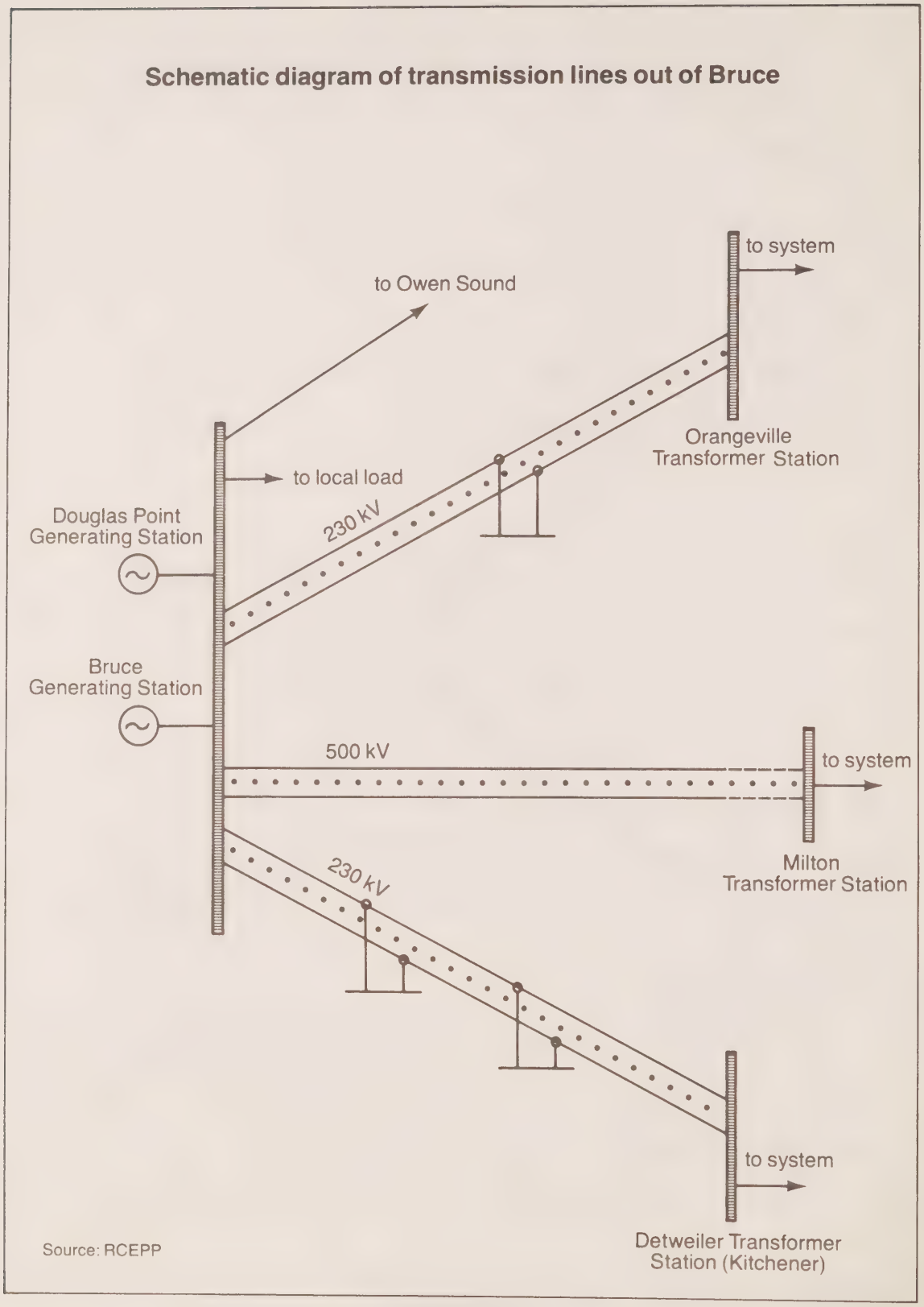

Schematic diagram of transmission lines out of Bruce
to system
to Owen Sound
Orangeville
Transformer Station
to local load
230 kV
Douglas Point
Generating Station
Bruce
Generating Station
500 kV
to system
Milton
Transformer Station
230 kV
to system
Detweiler Transformer
Station (Kitchener)
Source: RCEPP

FIGURE 9.2

(b) The power supply to loads in the northeast must use the two circuits from Detweiler T.S., which are designated D4W and D5W.

(c) The power supply to loads in the east must use the three circuits from Middleport T.S., which are designated M31W, M32W, and M33W.

Furthermore, Ontario Hydro has argued that, in the light of recent load and resource forecasts, future base load requirements of the total system will be supplied, to an increasing extent by nuclear stations, especially after the putting into service of the Pickering B, Bruce B, and Darlington generating stations. The implication of this, with the generous reserve margins that have been forecast for the 1980s, is that in future less primary electricity production will be required from the fossil-fuelled generating stations, including Keith and Lambton. There is the further implication that Ontario Hydro would like to be able to use the main 230 kV trunk lines funnelling from the east into Buchanan T.S. to supply more of the load in the Windsor-Sarnia area than it has recently been doing. If this is not possible, then, according to Ontario Hydro, Keith and Lambton will have to be operated at higher capacity factors than their place in the "merit order" of stations suggests.

Interconnections with Michigan

The existing interconnection facilities consist of a 230 kV link at Windsor, another 230 kV link at Sarnia, and two 345 kV circuits connecting the Lambton Generating Station with the Detroit Edison Company system. These facilities provide a nominal maximum transfer capability with Michigan of 2,855 MW. However, this capability is sharply limited by a variety of factors, particularly, from instant to instant, the specific balance of loads and resources, on the one hand, and the transmission system configurations on each of the interconnected Ontario, Michigan, and associated systems, on the other. Notable also is the complicating feature associated with the interconnections between Ontario, Michigan, and New York, which takes the form of "circulating power" around Lake Erie and Lake Ontario; even without net import or export, power may flow from Ontario to Michigan and re-enter Ontario from New York, or vice versa.

Ontario Hydro argues that, because of limitations on the capability of circuits into Buchanan T.S., its ability to export power, even with upgrading, will be progressively more constrained in the future. According to Ontario Hydro, if one of the critical main (not tie-line) double-circuit 230 kV lines is out of service, the capability for normal export sales

(not emergency assistance sales) to Michigan is now in the order of 1600 MW, assuming no generation rejection. If area loads grow as Ontario Hydro anticipates, this export capability will drop to about 900 MW by 1986.

Notwithstanding government policy favouring the strengthening of interconnections and the marketing of surplus power to neighbouring utilities (see Appendix E), the potential for the firm export of power, predicated on Ontario Hydro's 1979 Load Forecast, is not particularly promising. Any export commitments would shift the load projections shown in Fig. 9.5 upwards and advance the date at which the delivery capability of bulk power facilities in SW Ontario would be exceeded. Although Ontario Hydro has been actively exploring the possibilities, there is no evidence to date that contracts for the export of firm power from Ontario Hydro and neighbouring U.S. utilities are likely to be negotiated within the next few years. Insofar as interruptible power is concerned, the prospects seem likely to remain much as they are at present (Ontario Hydro made a net profit of $245 million on sales of 23,000 MW.h in the three years 1976-8). In addition, as discussed in Section VIII, the benefits of being interconnected with the large U.S.-interconnected power network is an important asset that facilitates system stability.[1]

Ontario Hydro's Stop-Gap Measures

As pointed out previously, it is possible to upgrade transmission lines on an interim basis. Some important steps in this respect are planned to stretch the capability of the main 230 kV transmission lines into the Buchanan T.S. (Table 9.1). These are:

(a) the installation of larger conductors with increased power-carrying capacity on all of the main trunk 230 kV circuits from Orangeville T.S. to Detweiler T.S., and around the Detweiler T.S.-Buchanan T.S.-Middleport T.S. triangle;

(b) the acceptance of overhead conductor temperatures in excess of established practice, thereby allowing increased power flows under the same ambient temperature conditions;

(c) the acceptance of the possibility that it may be necessary to raise the height of towers, in consequence of steps (a) and (b) above, which may give rise to increased conductor sag;

(d) the progressive installation, in the order of 1,500-2,000 MW, at transformer stations throughout the region, of static capacitors to maintain acceptable voltage levels,

(e) the acceptance of reduced standards of reliability of certain transformer stations serving the Ingersoll-Brantford-Tillsonburg area, in the interest of maximizing the capability of the main trunk system;

TABLE 9.1 - Summary of Capacity Increases Planned on Existing 230 kV Transmission Lines in Southwestern Ontario

	Winter Ampacity	
	Prior To Uprating (Amperes)	Uprated (Amperes)
230 kV cct Line M31W Middleport TS - Buchanan TS	1220	2040
230 kV 2 cct Line M32/33W Middleport TS - Buchanan TS	1790	2600
230 kV 2 cct Line D4/5W Detweiler TS - Buchanan TS	1310	2040
230 kV 2 cct Line D6/7V Detweiler TS - Orangeville TS	1390	1650
230 kV 2 cct Line M20/21D Middleport TS - Detweiler TS	1710	2600

Source: Ontario Hydro, Exhibit SW-4, "Bulk Power Facilities SW Ontario", December 1978, p.15

(f) the carrying out of various miscellaneous station modifications, to accommodate increased power flows.

Maximum line loadings that will be adopted as a result of these measures, according to Ontario Hydro, will be appreciably in excess of its established practice. However, it is anticipated that acceptable standards of service will be provided although some deterioration is inevitable. It is also worth noting that there will be substantially increased power losses, for the most part in the transmission lines but also in the transformers, due to conductor heating under heavy loadings.

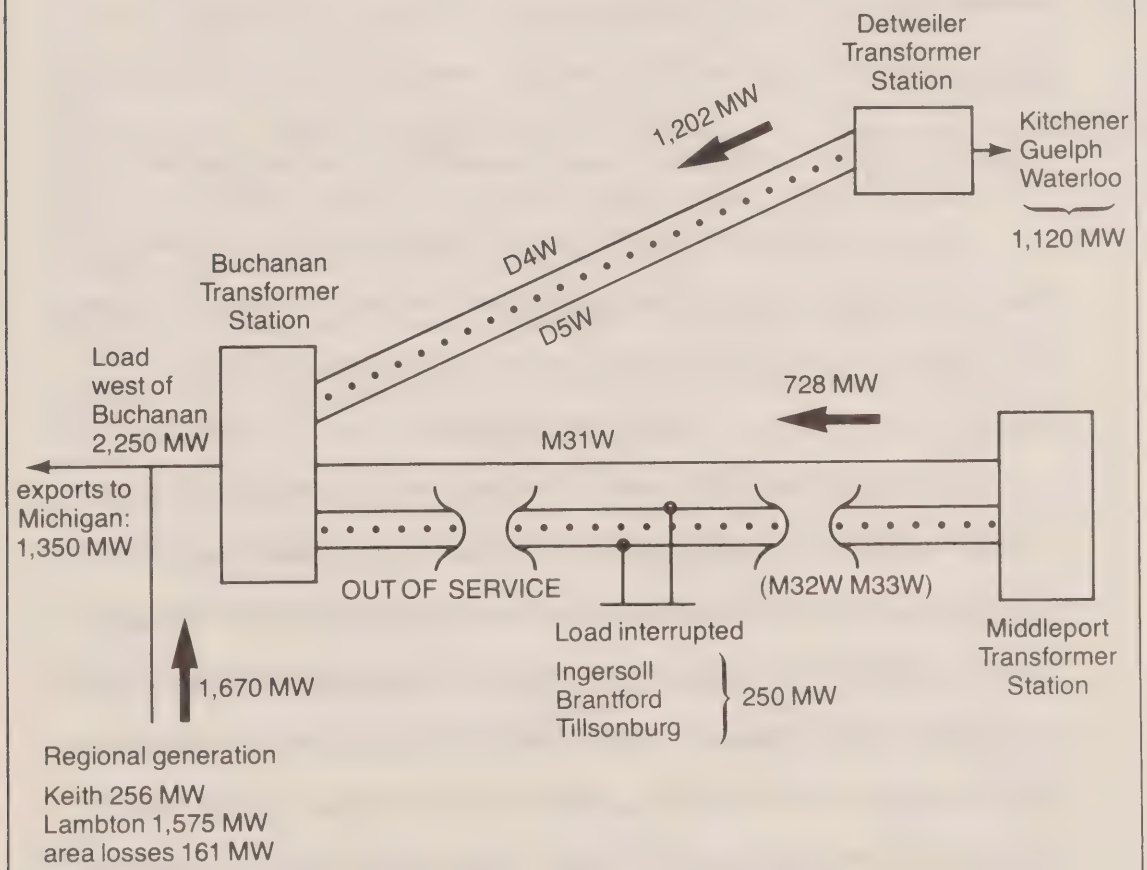
Design and Operating Criteria

Following the massive power failure of November 1965, Ontario Hydro joined with 20 other utilities to establish the Northeast Power Co-ordinating Council (NPCC), which formulated basic criteria for the design and operation of interconnected power systems; these criteria have been adopted by the individual utilities as guidelines for accepted practice.

Ontario Hydro has stated that, in assessing the adequacy of the main trunk circuits into the Buchanan T.S., they took into consideration critical system conditions that reflect the intent of the NPCC basic criteria and, in particular,

Critical region load flow – January 1987
Scenario A

Scenario A: 2-circuit 230 kV line from Buchanan to
Middleport out of service
three units of Lambton Generating Station
and all four units of Keith Generating
Station in service
area demand 3,600 MW
exports: to Michigan 1,350 MW; to
New York 650 MW – total 2,000 MW



Source: RCEPP

FIGURE 9.3

the adequacy of the main trunk system under a variety of contingency situations. When the interim measures are in place, Ontario Hydro has indicated, the maximum critical area load[2] that can be supplied with an adequate degree of reliability, and, in particular, as limited by the "stretched capability" of the London 230 kV trunk lines, will be as follows:

Scenario A

3,600 MW, if a 2,000 MW firm export capability to the U.S. is maintained.

Scenario B

4,000 MW, if no firm power export capability is maintained.

Fig. 9.3 depicts the situation under Scenario A, and the most severe design contingency considered by Ontario Hydro, i.e. three of the four Lambton units in service and the double-circuit 230 kV line from Middleport T.S. to Buchanan T.S. (M32W and M33W) out of service. Under these conditions, supply to the Ingersoll, Brantford, and Tillsonburg transformer stations would be interrupted and the remaining three circuits into Buchanan T.S., especially circuit M31W from Middleport T.S., would be heavily loaded. For example, Ontario Hydro estimates that circuit M31W, when upgraded, will be loaded to its full capacity of 728 MW when the total load in the London-Windsor-Sarnia region amounts to 2,250 MW; this would correspond to a total load

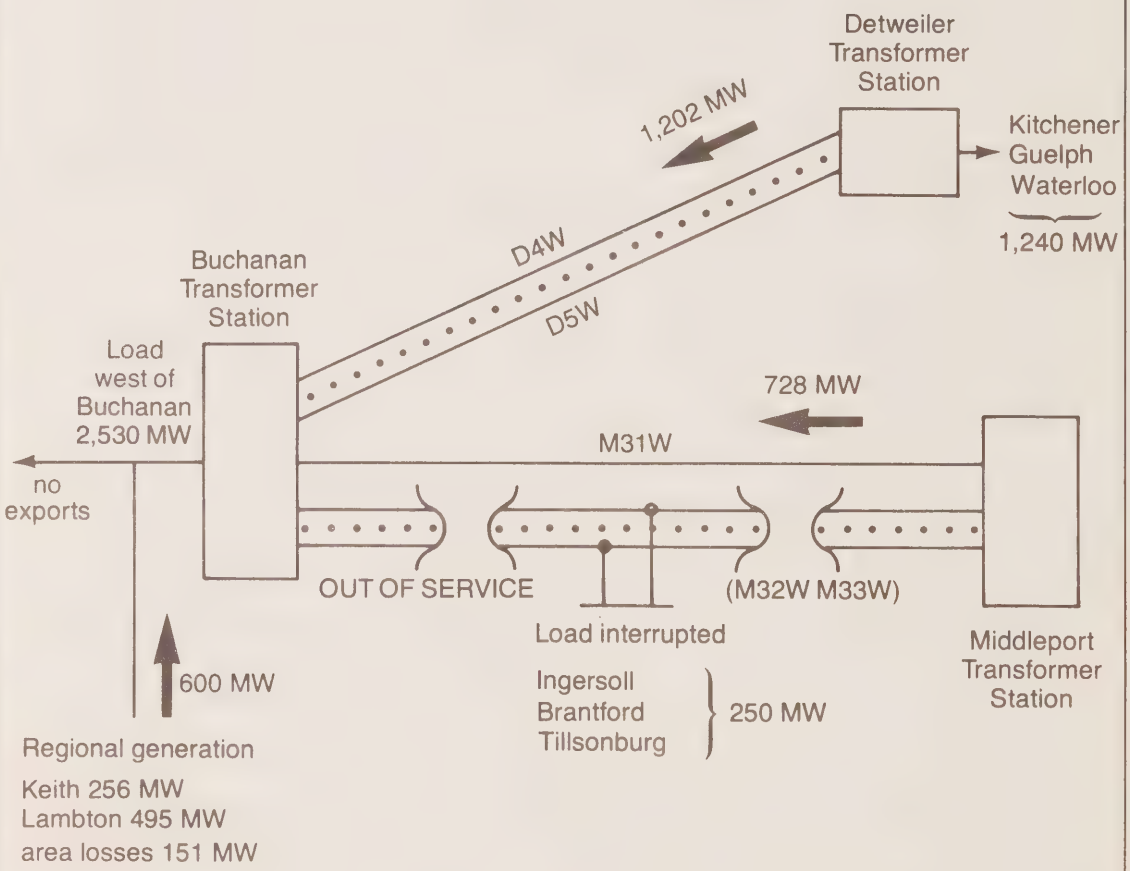
in the entire SW Ontario region in the order of 3,600 MW. On the basis of Ontario Hydro's 1979 Load Forecast, the SW Ontario coincident peak transformer station load will amount to nearly 3,600 MW in January 1987.

Turning now to Scenario B (SW Ontario load of 4,000 MW and no export to U.S.A.), and assuming that circuits M32W and M33W are unavailable and that only one Lambton unit is in service, the situation will be as depicted in Fig. 9.4. On the assumption that the London-Windsor-Sarnia loads total 2,530 MW, it will be noted, circuit M31W would be operating at its full stretched capability of 728 MW. In these circumstances, it is estimated that the corresponding total southwestern region load would be 4,000 MW. According to Ontario Hydro's 1979 Load Forecast, the southwestern region coincident peak demand will be an estimated 4,090 MW in January 1990.[3]

The capability of the bulk power system to supply the critical load area in SW Ontario under the most severe design contingency is shown in Fig. 9.5 in conjunction with several load growth projections, i.e. average annual growth rates of 2.75 per cent, 3.5 percent, and approximately 4.3 per cent, which is Ontario Hydro's 1979 Load Forecast. With growth rates in the coincident January peak for this critical area load of 2.75 per cent and 3.5 per cent respectively, the corresponding years

Critical region load flow – January 1987
Scenario B

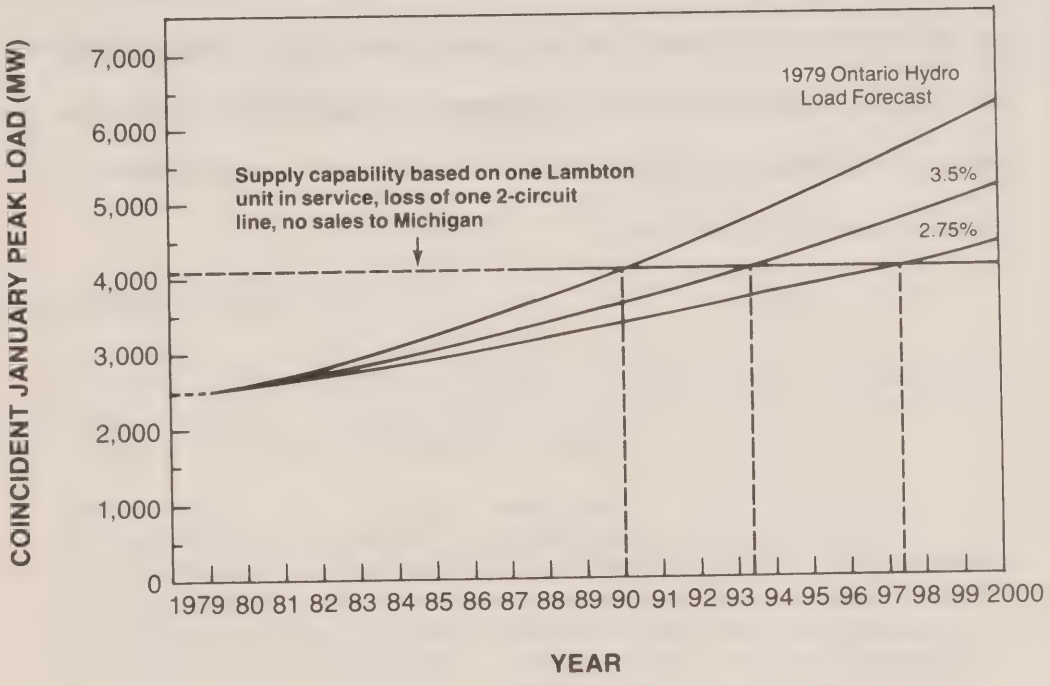
Scenario B: 2-circuit 230 kV line from Buchanan to
Middleport out of service
one unit of Lambton Generating Station
and all four units of Keith
Generating Station in service
area demand 4,000 MW
no exports



Source: RCEPP

FIGURE 9.4

Load growth projections for southwestern Ontario critical area load



Source: RCEPP

FIGURE 9.5

of criticality will be 1997 and 1993. If the load growth were to exceed these levels, we do not believe it likely that it would be greater than Ontario Hydro's 1979 Load Forecast. This still gives an in-service date for new facilities of 1990 compared with Ontario Hydro's suggested date of 1987. We believe that these dates are realistic, taking conservation, fuel-substitution, and load-management measures into account, and this means that adequate time, in the order of at least two or three years, will be available for the in-depth studies we recommend in Section XI, without unduly jeopardizing the integrity of the main transmission trunk lines in the region.

X - THE INCORPORATION OF BRUCE GENERATING STATION B

Nothwithstanding our conclusion that the arguments put forward by Ontario Hydro, relating to the potential load growth in SW Ontario to the year 1987 and beyond, are unconvincing, and that lower load growth rates are more probable, we nevertheless accept the incorporation of Bruce Generating Station B into the electric power system as an essential requirement. In this section, we will first state Ontario Hydro's case and then present our observations.

Ontario Hydro's Case

The Conclusions (Section 4.0) of Ontario Hydro's submission, "Bulk Power Facilities SW Ontario", begin:

> With respect to the first requirement, the incorporation of Bruce GS B, it would have been desirable to have a transmission line in service by November 1982, the synchronizing date for the first unit at Bruce GS B, because the existing and approved transmission lines are not adequate to incorporate this plant. However, the earliest possible in-service date for a new transmission line is late 1986. Planning should proceed now to provide new transmission as soon as possible for the incorporation of Bruce GS B.

Because the need for additional transmission facilities from the Bruce Nuclear Power Development relates to the existence of the four Bruce A units, and to the in-service dates for the Bruce B units which have already been committed, it is independent of load growth in SW Ontario. However, Ontario Hydro's future capability to supply

loads in the region will, we are convinced, be affected if transmission facilities from Bruce are inadequate.[1]

Four units (Bruce A, with an installed peak electric capacity of 2,960 MW) of the eight units planned for the Bruce complex are now in service. (Note that the seven 230 kV circuits at present available have a capacity to remove 2,340 MW;[2] even taking the local loads into account, some power may be said to be "bottled up" even today.) Construction of the remaining four units (Bruce B was authorized by the Cabinet in November 1974) is based on the following scheduled in-service dates:

Bruce 5	October 1983
Bruce 6	July 1984
Bruce 7	April 1986
Bruce 8	January 1987

Without a second 500 kV line from Bruce, two main alternatives are open to Ontario Hydro:

(a) It can limit the output of the Bruce complex. This means that, although eight generating units are available, the plant would be operated at no more than 3,350 MW, thus "locking in" about 3,000 MW. In addition to the problems of generation rejection, discussed previously, replacement of this locked-in energy would result, according to Ontario Hydro, in a penalty of well over $100 million per year for fuel costs alone.[3] Further, assuming a capacity value of $100/kW per year, there could be a further penalty of $300 million per year, assuming that this capacity could be exported.

(b) It can employ load as well as generation rejection. This would avoid some of the economic penalties. But it was stressed by Ontario Hydro that this alternative carries considerable risk, insofar as its feasibility has not been conclusively established. For example, if a double-circuit fault occurred on the 500 kV line from Bruce GS to Milton T.S. (now in process of completion) and, in consequence, the circuits were disconnected instantly, then, within a fraction of a second, the power from Bruce would surge down the only paths still available, i.e. the lower-capacity 230 kV circuits. These circuits are quite incapable of carrying the excess power, and unless heroic measures were taken the power system would collapse. These measures include immediate generation and load rejection, in order to prevent the collapse of the system. Upon loss of the two-circuit 500 kV Bruce-Milton line, Bruce units and selected transformer station loads would be tripped, as follows:

TABLE 10.1 - Generation and Load Rejection Requirements

Bruce units in service (pre-fault)	Bruce units rejected	Load rejected (MW)
4	2	0
5	3	750
6	4	1,500
7	5	2,250
8	6	3,000

SOURCE: Ontario Hydro

The feasibility of rejecting up to six Bruce units is not yet established; Ontario Hydro is undertaking detailed studies. During the hearings, the utility stressed that, if generation and load rejection were relied upon to deal with such emergency situations, then:

- A large component of the electric power system would be subject to power interruptions, with consequent safety hazards and economic loss to industry.
- Power interruptions would probably be unacceptable to the public, and would adversely affect Ontario Hydro's relations with its interconnected neighbours as well as its ability to sell surplus power to neighbouring utilities.

To avoid the above-mentioned consequences, Ontario Hydro has argued, additional transmission facilities should be available no later than the mid-1980s, when Bruce B is to be put into service.

The Commission's Observations

(a) Ontario Hydro's East System peak generation capacity is shown in Table 10.2. Included are existing stations as well as Pickering B; excluded are Darlington GS and Wesleyville GS.

TABLE 10.2 - Ontario Hydro East System Peak Resources (MW)

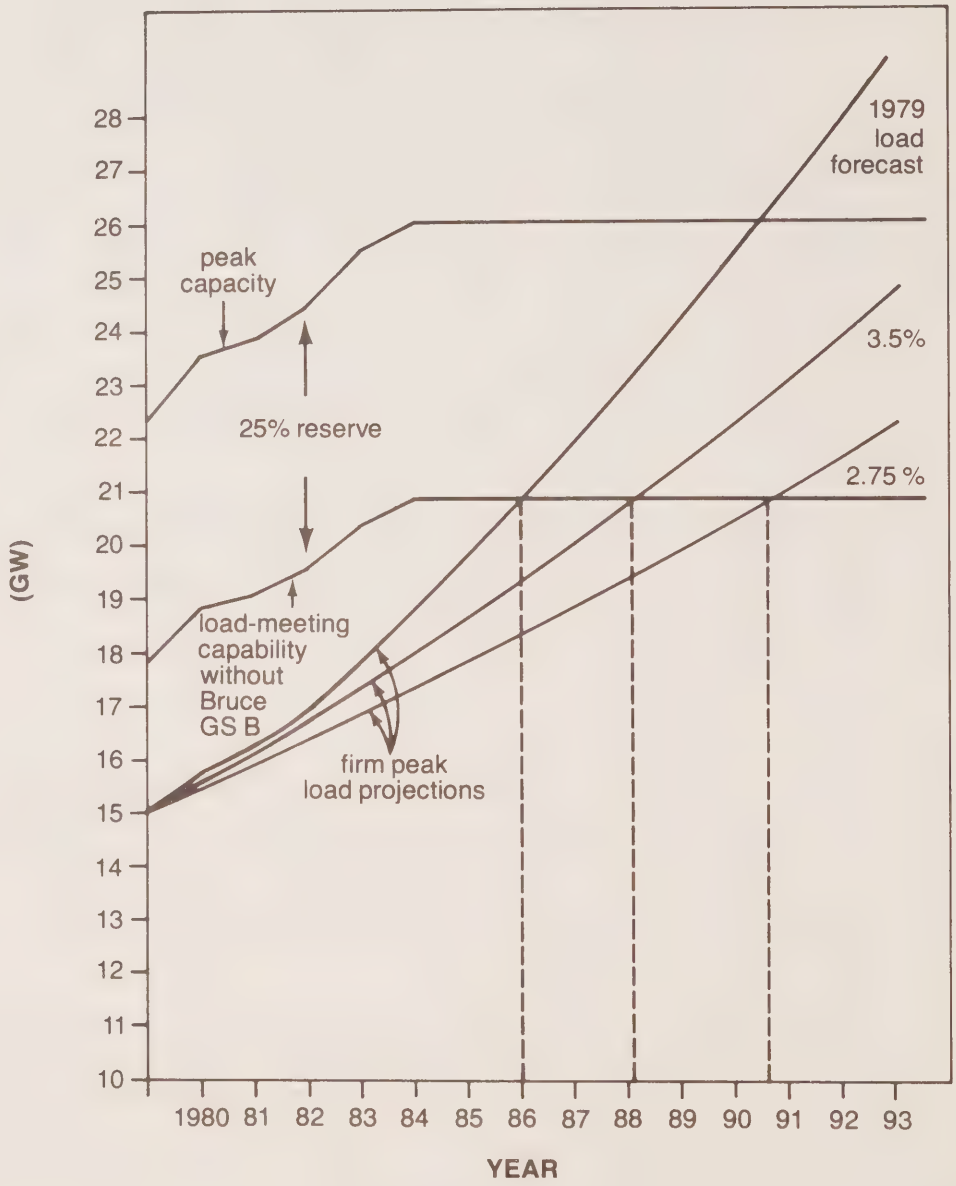
	Without Bruce B	With Bruce B
Hydraulic (dependable)	5,920	5,920
Conventional fossil	12,311	12,311
Combustion turbines	494	540
Nuclear	7,312	10,336
TOTAL	26,037	29,107
Load-meeting capability	20,830	23,285

SOURCE: Ontario Hydro Power Resources Report No. 790201

In order to determine the latest in-service dates for Bruce B units, consistent with maintenance of system reliability, we show graphically in Fig. 10.1 the peak capacity and the corresponding load-meeting capability of the system (see Table 10.2), based on the most recently announced in-service dates for the facilities. Also shown are three projections of firm peak loads corresponding to those shown in Fig. 9.5. The following assumptions have been made:

- The latest in-service date is predicated on the load-meeting capability of the system and not on economic considerations.
- The load-meeting capability is based on a reserve margin of 25 per cent of the firm peak load.

**Ontario Hydro East System –
peak generating capacity without Bruce GS B
and firm peak demand**



Source: RCEPP (see Table 10.2)

FIGURE 10.1

- The annual load growth rates of 3.5 per cent and 2.75 per cent are applied to the primary peak loads. The firm peaks are obtained from the primary peaks by subtracting 500 MW of interruptible load.
- No provision has been made for load management.
- The annual peak load is assumed to be the January peak rather than the December peak.
- Load projections are based on the 1978/79 East System primary peak of 15,580 MW.

If we consider the load-growth scenarios based on

- Ontario Hydro's 1979 Load Forecast
- a 3.5 per cent compounded average annual growth
- a 2.75 per cent compounded average annual growth

then the corresponding latest in-service dates for the first unit of Bruce B are 1985-6, 1988-9 and 1990-1, respectively. Accordingly, there could be a delay of two to three years in the Bruce B in-service dates. However, and this cannot be over-emphasized, this would be based on the acceptability to Ontario Hydro and its customers of penalties, not least the additional cost of coal generation as compared with nuclear generation.[4] On the other hand, especially in the light of recent "nuclear incidents", it is highly desirable for additional safety measures and improved operator training facilities

to be put in place, and these will take time. Furthermore, as stressed elsewhere in this report, we are convinced that scenarios incorporating alternative generation technologies, upon which system planning should be based (at least in part), are required. Concomitantly, much more information is essential, relating, for example, to land use, and the implications of proliferating energy conservation.

(b) Depreciation and interest charges represent more than half the cost of power from an operating nuclear plant. They are recovered from customers whether or not the station is delivering energy to the electric grid. When nuclear units stand idle while fossil-fuelled generators supply the load, there is an expense to the system over and above such "sunk costs", consisting of the difference between the cost of the fossil fuel used to generate the required energy and the much lower cost of the nuclear fuel that would otherwise have been used. Completion of Bruce B, only to lock in its power because of inadequate transmission facilities, would result in additional fuel expenditures in the order of $150-200 million (1979 dollars) per year. The economic penalty would be much higher if there were no excess fossil-fuelled capacity in the system, as Ontario Hydro would then have to rely on imported power or face the possibility of brown-outs or black-outs.

Considerable replacement energy costs are unavoidable prior to 1986, which according to Ontario Hydro is the earliest in-service

date of a second 500 kV line out of Bruce. The full penalty would apply after units 7 and 8 enter service and until the line is completed.

The penalty could be reduced if there were savings associated with deferring nuclear construction expenditure because of inadequate transmission facilities. Because a large proportion of the capital cost of units 5 and 6 has already been committed, there would appear to be little to be gained by deferral of these units. Units 7 and 8 are not so far advanced. There is probably little advantage in completing them before the second 500 kV line is available. Ontario Hydro is of the opinion that units 7 and 8 should be completed according to their schedule, whether or not a second 500 kV line is available. Although we believe that the cost of power locked in at Bruce B when units 7 and 8 are deferred and the second line is unavailable would be less than the $150-200 million per year referred to earlier, we recognize that we do not have sufficient evidence to decide one way or other on the over-all validity of Ontario Hydro's case for the timing of these two units.

(c) There are compelling social, environmental, and economic reasons why approval for a second 500 kV line out of Bruce will be difficult to obtain, regardless of the routings proposed by Ontario Hydro. In applying to the Environmental Assessment Board for approval of such a facility Ontario Hydro should, in our view, show that it has considered a variety of scenarios that might

incorporate, for example, several dual-purpose (electric plus thermal power) stations close to load centres, energy storage facilities, and co-operative ventures with municipal and private suppliers.

XI - SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

The Commission was requested to consider and report on the following matters:

- load growth in the SW Ontario region up to the end of 1987 and from 1987-2000
- the capability of existing and committed bulk power generation and transmission facilities to supply this load to the region
- the resulting date at which additional bulk power facilities, if any, will be needed

In effect, the establishment of load growth is predicated essentially on the load-forecasting methodology. We therefore summarize below our findings with respect to the load forecasts in the SW Ontario region and how these might be supplemented in the future. We then consider the complementary issues of load growth, the adequacy of generation facilities, the capability of bulk power transmission facilities, and, finally, the incorporation of Bruce Generating Station B.

The SW Ontario Load-Forecasting Methodology

We have concluded that the load forecast presented by Ontario Hydro has not provided us with a realistic basis upon which to consider meaningfully the future dates at which additional bulk facilities, if

any, will be needed in the region. Indeed, we have concluded that a major effort should be made by Ontario Hydro to develop load-forecasting methodologies predicated increasingly on the end-uses of electric power, and that appropriate econometric models (e.g. the SRI-CEA model) should be further developed. During the next decade, special efforts should be made to assess the impacts of conservation practices and load management on load growth. In the Commission's Final Report, recommendations will be presented with respect to such topics as the encouragement of energy conservation and load management, the development of alternate sources of energy (especially solar and biomass energy), the future role of dual-purpose power production (electric and thermal power), and the enhancement of system resilience by the development of an appropriate mix of generating technologies. Potential developments in these areas will clearly have significant impacts on future load growth and on system planning.

Load Growth in SW Ontario

During the last two years, the Commission has been undertaking an in-depth study of the factors affecting the future demand for electric power in Ontario. Our findings will be presented in the Final Report. Suffice it to state, at this penultimate stage of the research, that the average projected (compounded) load growth for the whole system to the year 2000 could, in our opinion, drop below the 4 per cent per annum that we suggested in our Interim Report on Nuclear Power. We

believe that the evidence put forward by Ontario Hydro does not substantiate the conclusion that the average load growth for SW Ontario is greater than that for the system as a whole. Under the circumstances, we are justified in concluding that a drop in system load growth will be matched by a corresponding drop in the regional growth.

Adequacy of Generation Facilities in SW Ontario

Several announcements relating to Ontario Hydro's excess generating capacity have been made during the last few months. It is expected that these excess generation levels will characterize Ontario's electric power system during the next decade, and perhaps beyond. The region designated SW Ontario for the purpose of our inquiry is particularly well endowed with both coal-burning and nuclear power stations (see Table 6.1). On the basis of Ontario Hydro's 1979 Load Forecast, which we believe to be high, the coincident January peak load for the SW Ontario region is forecast to be in the order of 9,500 MW by the year 2000 (at present it is about 3,500 MW), while the peak capacity of the bulk power generating facilities in the region (including Bruce B) will be approximately 13,150 MW. Assuming a reserve margin requirement of 25 per cent, the load-meeting capability of these facilities will be 10,520 MW. It is clear, therefore, as stressed by several interveners during the hearings, that a major role for these SW Ontario generating facilities (especially Nanticoke and Bruce A) is to supply power to parts of the province that lie outside our designated region. Moreover,

it is recognized that, given government policy on interconnections, and conditional on the adequacy of bulk power transmission facilities and tie-lines, excess generating capacity (over and above the 25 per cent reserve margin) can potentially be profitably utilized for the export of power to the United States.

Capability of the Bulk Power Transmission Facilities (SW Ontario)

Ontario Hydro panels presented, during the hearings, an impressive case relating to the limited capabilities of existing and potentially upgraded transmission lines in the area, particularly when the system is subjected to a variety of fault conditions. We have nothing but praise for the lucid and extremely competent manner in which this complex subject was treated. In particular, we noted that, although non-optimal and, indeed, undesirable from the standpoints of power system reliability, long-term integrity and economics, the stop-gap steps that Ontario Hydro has in hand to upgrade several key transmission lines in SW Ontario (see Section IX) are essential. These measures will stretch out the capabilities of these lines (see Table 9.1) during the interim period, pending the construction of permanent transmission facilities (see, for example, Fig. 9.5).

Assuming the loss of a two-circuit line with all other circuits in service, one unit in service at Lambton, and zero net interchange with Michigan (this is the most limiting condition considered in Exhibit SW-4), and assuming load growth for the region based on Ontario Hydro's

1979 Load Forecast, the supply capability and projected demand would coincide, theoretically, in January 1990. If a lower load growth rate is assumed, this critical date would be delayed. We have concluded, on the grounds that the 1979 Load Forecast is probably too high, that a later year, perhaps 1994, is more likely to be the "critical year".

We fully recognize that the existing situation will become unacceptable if no action is taken to resolve it. As the critical cross-over point is approached, the security of power supply to the SW Ontario area would become lower than that prevailing generally in Ontario, which is not in our view a desirable situation. Undue delay in taking corrective action would permit a continuous decline in the ability of Ontario Hydro to interchange power with neighbouring U.S. systems. It would tend to increase line losses, and this could counter conservation achievements representing more than 100 MW. It might also necessitate the purchase of expensive static capacitors and auxiliary equipment that might not otherwise be necessary. Notwithstanding these arguments, we believe that there could be some delay in the proposed Ontario Hydro schedule, to provide the breathing space so urgently needed for detailed studies of alternative electric power scenarios.

Incorporation of Bruce B

Ontario Hydro regards this as the most crucial problem at present. It is important to note also that the incorporation of Bruce A into the bulk power system, in particular through the double-circuit 500 kV line (Bruce-Milton), is by no means secure. This was recognized by the Government of Ontario in July 1974, when the then Minister of Energy, the Honourable W. Darcy McKeough, stated that the government was withholding approval for the second transmission corridor from the Bruce Generating Station to the Kitchener area despite the "serious consequences" that such a decision might have from the system-security standpoint. The Goverment of Ontario, he said, "simply accepts the responsibility ... for this temporary decrease in system security". For example, both circuits might be subject to forced outages, with certain rejection of generation at Bruce if more than two units were in service at the same time. The incorporation of Bruce B would compound the problem.

Our findings are summarized below:

- The underlying reason for Ontario Hydro's desire to complete Bruce B and to incorporate the station into the network is clearly economic: nuclear generated energy from a station already partially completed is appreciably cheaper than coal-generated energy from an existing station. The Commission accepts that this is the case with respect to Bruce B units 5 and 6. However, we feel that the case has not been clearly made for the completion of units 7 and 8 according to the

Ontario Hydro schedule, which appears to be independent of the in-service date for a second 500 kV line out of Bruce.

- The Bruce nuclear complex is a major component in the total electric power system. Decisions relating to how it can most effectively be incorporated into the system must be predicated on the development of a broad range of alternate scenarios that includes unconventional concepts and technologies. We are not convinced that the "alternative scenarios" we have in mind are being adequately explored by Ontario Hydro. We stress also that the Commission's Final Report, at present in preparation, will address many related questions, not least those concerning land use, the decision-making framework, the role of the public, financial factors, etc. These topics have been central to our inquiry.

- The views we expressed in our Interim Report with respect to nuclear safety have been fortified by the Three Mile Island nuclear plant accident. It is important, now, that more attention be paid to operator training, to communications, and to quality control in respect to the operation of all nuclear power plants. Because of this requirement, a slowed-down construction programme at Bruce would, in our opinion, enhance safety and environmental protection.

Recommendations

The Commission was urged by Ontario Hydro to recommend that "the process now underway of studying alternatives, selecting a plan and specific locations for facilities must continue."[1] If, and only if, the "process now underway" is as broad-ranging as indicated in the following specific recommendations do we endorse Ontario Hydro's proposal. We recommend:

1. that because the existing load projections have limited credibility, high priority should be given to developing forecasting methodologies predicated on end-use econometric models. The impacts of energy conservation, load management, solar energy, and the possible accelerated use of natural gas for space and water heating should be identified and reflected in the load forecasts. We recommend further that the load forecasts be viewed in the light of possible financial constraints and new energy pricing policies, so that viable electric power planning scenarios can be formulated;

2. that detailed studies of the potential capability and reliability of bulk power facilities in SW Ontario, upgraded where necessary, and operating in a variety of modes (but not necessarily predicated on minimization of the cost of energy), should be undertaken urgently. These should take into account the possible incorporation of several dual-purpose (electric plus thermal power) generating stations

of, say, 200-400 MW(t) capacity at strategic locations. Special attention should be paid to the problem of strengthening system interconnections from both the operational and the export points of view;

3. that studies relating to the incorporation of Bruce Generating Station B should include a re-evaluation of the economic and social implications of delaying the completion of units 7 and 8;

4. that because we foresee serious social as well as environmental and economic problems associated with the possible construction of a second 500 kV line from Bruce following any route that crosses the prime foodlands of Ontario, all other alternatives, including those proposed in recommendation 2, even if there are apparent economic penalties, should be explored fully before further consideration is given to such a proposal;

5. that only when the above studies have been completed will an adequate evaluation of viable alternative electric power scenarios be meaningful; and that during the conduct of these studies, which will provide an excellent information base for appropriate Environmental Assessment Board hearings, the public should be kept informed through seminars, workshops, debates, etc. of details of the scenarios and of the load-forecasting processes, and provided with basic information relating to specific planning processes.

As stressed in the Introduction to this report, it is important that the report be read in conjunction with the Commission's Final Report. We will address in some detail, for example, the central issue of the decision-making framework as it relates to electric power planning, and the role of the public. We urge, therefore, that major decisions, especially those involving basic planning concepts, some of which have been introduced in this report, be viewed in the light of the conclusions and recommendations of our Final Report. This will be a good beginning.

A P P E N D I C E S

TERMS OF REFERENCE

The Royal Commission on Electric Power Planning has been empowered and instructed under Order-in-Council number 2005B/75 dated the 17th day of July, A.D. 1975 to:

1) Examine the long-range electric power planning concepts of Ontario Hydro for the period of 1983-93 and beyond and to report its findings and recommendations to the Government, so that an approved framework can be decided upon for Ontario Hydro in planning and implementing the electrical power system in the best interests of the people of Ontario;

2) Inquire comprehensively into Ontario Hydro's long-range planning program in its relation to provincial planning; to domestic, commercial and industrial utilization of electrical energy; to environmental, energy and socio-economic factors, including load growth, systems reliability, management of heat discharged from generating stations, interconnecting and power pooling with neighbouring utilities, export policy, economic investment policy, land use, general principles on the siting of generating utilization of electrical energy and wise management (conservation) of primary energy resources, power generation technology, security of fuel supplies and operational considerations;

3) Deal primarily with the broader issues relating to electric power planning, and thus serve to alleviate the need for re-examination of these issues at subsequent hearings of other hearing bodies on specific details such as siting, rates, etc.;

4) Consider and report on a priority basis on the need for a North Channel Generating Station, a second 500 k.V. line from Bruce, a 500 k.V. supply to Kitchener, a 500 k.V. line from Nanticoke to London, and a 500 k.V. line in the Ottawa-Cornwall area, and other projects as may be directed by the Lieutenant Governor in Council.

Paragraph 4 was amended and supplemented under O.C.3489/77 dated the 14th day of December, A.D. 1977 to include that the Royal Commission on Electric Power Planning be instructed and empowered to complete its examination of issues relating to nuclear power, to prepare an interim report of its opinions and conclusions in this area, including the extent of the need for nuclear as a component of Ontario's future energy supply and the proportion of nuclear power in Ontario Hydro's future generating capacity, and to provide such report on or before the 30th day of June, A.D. 1978.

Paragraph 4 was further amended under Order-in-Council number 2065/78 dated the 12th day of July, A.D. 1978, as follows:

A) Having concluded its hearings with respect to paragraphs 1, 2, and 3 of its terms of reference;

i) For the geographic area of Ontario south of Bruce Nuclear power development and west of a line between Essa transformer stations and Nanticoke generating station, consider and report to the Minister of Energy on or before May 31, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing and committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of inter-connections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their locational and environmental aspects; and

ii) For the geographic area of Ontario east of Lennox generating station, consider and report to the Minister of Energy on or before June 30, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing and committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of interconnections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their locational and environmental aspects;

B) Provide the Government with its report and recommendations on paragraphs 1, 2, and 3 of these terms of reference on or before October 31, 1979.

Ontario

Office of the Chairman

Royal Commission on Electric Power Planning

416/965-2111

7th Floor
14 Carlton Street
Toronto Ontario
M5B 1K5

APPENDIX B

NOT TO BE RELEASED UNTIL

TUESDAY, 6 March 1979 2:00PM

ROYAL COMMISSION ON ELECTRIC POWER PLANNING

REGIONAL HEARINGS TO CONSIDER BULK POWER FACILITIES IN S.W. ONTARIO

Chairman's Opening Statement

Because concern has been expressed relating to the need for these hearings, in view of recent announcements concerning Ontario Hydro's excess generating capacity, it is appropriate that I should open this first session with a statement that I hope will put the purpose and value of the hearings into adequate perspective.

Let me begin by quoting from paragraph 4, as amended under Order-in-Council dated 12 July 1978 of our terms of reference:

"(A) Having concluded its hearings with respect to paragraphs 1, 2 and 3 of its terms of reference;

i) For the geographic area of Ontario south of Bruce Nuclear power development and west of a line between Essa transformer station and Nanticoke generating station, consider and report to the Minister of Energy on or before May 31, 1979 on load growth in the area up to the end of 1987 and from 1987 to the year 2000, the capability of existing and committed bulk power generation and transmission facilities to supply this load to the area taking into account Government policy with respect to the use of interconnections with neighbouring utilities, and the resulting date at which additional bulk power facilities, if any, will be needed, but excluding consideration of the specific nature of the additional bulk power facilities which may be required and of their

In consequence of the above Ontario Hydro prepared a detailed analysis of the potential load growth in the area, and the capability of existing facilities to meet this growth. On October 25, 1978 we wrote to Ontario Hydro expressing our hope that this report would include in-depth information on several factors that, in our view, would be important determinants of the electrical load growth in the Southwestern Ontario area, as follows:

- population growth
- housing starts
- electrical energy needs of industry and agriculture, especially new industries.
- additional electrical energy needs of the commercial sector.

We received Ontario Hydro's submission - "Requirement for Additional Bulk Power Facilities in Southwestern Ontario" on December 28, 1978. Copies of this document were distributed widely to municipalities, local hydro offices and special interest groups during January 1979.

During the period January 5 - 14, 1979, the submission was studied in depth by the Commission and staff and we concluded that the information, supplied by Ontario Hydro, was inadequate for our purposes on several grounds, not least because it was extremely difficult to understand (even by a former Professor of Electrical Engineering!). This view was fully endorsed by several outside consultants. In consequence, a comprehensive set of questions was developed, and these were presented to representatives of Ontario Hydro at a meeting, attended by Dr. Stevenson on behalf of the Commission, held on January 19, 1979. The areas needing clarification and the additional information required by the Commission were specified and explained at this meeting. The Ontario Hydro representatives agreed to prepare replies as expeditiously as possible, and these were in fact received in the form of a document "Bulk Power Facilities S.W. Ontario - Supplementary Information" on February 12, 1979. This report, as well, was widely circulated throughout the Southwestern Ontario area. Both the main

submission and the supplementary information document will be filed as exhibits and are available at the back of the room.

Unfortunately, although the replies to the majority of the questions assist in clarifying the original submission, the reply to what the Commission regards as the central question is not satisfactory. I refer to the question at the top of page 1 of the "Supplementary Information Document" - it is essentially Ontario Hydro's translation of the original question put by the Commission:

> "Does Ontario Hydro's load forecasting process use estimates of various factors such as population growth rates, growth in households (including type of housing and heating), commercial manufacturing and industrial growth and the related uses of electricity, and technological change in the use of electricity in order to forecast electrical growth? If so, could such estimates be provided."

In response, and I refer again to page 1 of the document, Ontario Hydro has stated that:

> "Estimates of such factors, and their relationship to electrical growth, represent the type of information which is useful when an end-use or explanatory approach is being used in forecasting. This has not been the approach taken by Ontario Hydro, with the result that the data gathered for Ontario Hydro's load forecasting is not of this type and has not been organized in this way. However, the load forecasting methodology used by Ontario Hydro does rely heavily on estimates of local load growth provided by Hydro's wholesale customers (the municipal utilities), by direct industrial customers and by Ontario Hydro's regional offices (for retail areas serviced directly by Ontario Hydro). Embedded in these estimates are judgements based on first-hand knowledge of the demand for electricity and local activities, factors or trends which will change these demands. During its participation in the regional hearings, it is intended that Ontario Hydro's regional personnel will be presenting, for discussion with the Commission, the local information which appears most pertinent to load growth in certain key

areas in Southwestern Ontario."

It will be noted that while Ontario Hydro intends to present some of the in-depth information requested by the Commission during these regional hearings, through the utilities' regional personnel supplemented, we understand, by staff of the local public utility commissions, this crucial information has been available neither to the Commission nor to the intervenors for detailed study prior to the hearings. As a result our own appraisal has been limited because of lack of information and the submissions and examinations in preparation will likewise be inhibited.

Last week we received copies of a report showing the results of the 1979 load forecast as it applies to Southwestern Ontario. It should be noted that our concerns in this area merely repeat those of the Select Committee of the Legislature in its June 1976 Report:

> "Hydro believes that its process, by relying on input and judgement from regional people, as well as the expertise of its knowledgeable economist in charge of load forecasting, identifies all of the relevant factors influencing electricity consumption and accounts for them to the maximum practical extent. In the view of the Committee, the process captures most of the relevant factors. However, the Committee found it virtually impossible to differentiate those captured during the main forecasting process from those included in the highly subjective final adjustment phase. In addition, the process does not permit a direct test of the effect of different assumptions on the eventual load forecast. Because it appears likely that important social, economic and demographic changes will impact directly on the future growth of demand for electricity, it is essential that the process capture these changes as accurately as possible. Because Hydro will be appearing regularly before public bodies (such as the Ontario Energy Board), it is essential that the impact of changes in underlying trends be identifiable. In light of the significant variations from recent historical trends, and the importance of reliable and understandable long-range forecasts, it appears Hydro needs to supplement the forecasting techniques it currently employs."

In consequence of the above, the Commission was faced with a dilemma - should the hearings be postponed sine die pending the availability of the information requested by the Commission, or should the hearings proceed as scheduled ? I have attempted to set out below the "pros" and "cons" of these options so that the people of Southwestern Ontario are fully informed of the situation:

Factors which tend to support the holding of the hearings as scheduled

- There is obviously a high degree of uncertainty, and indeed confusion, among the general public because of recent statements to the effect that Ontario Hydro's generating capacity is considerably in excess of that which would be considered as normal;

- Secondly, and concomitantly, Ontario Hydro's recent load forecast, for the period up to 2000 is appreciably lower in terms of average growth rate per year than previous forecasts. And furthermore, the evidence presented before the Select Committee on Hydro Affairs by the Ministry of Energy suggests that the utilities' forecast may still be too high. It is hoped and expected that our hearings will help to clear up some of the uncertainties concerning the adequacy of existing and committed generation and high voltage transmission line facilities;

- Members of the farming community have expressed their intention to participate actively in these hearings. A postponement of, for example, one month would preclude the participation of many farmers because of the intense activities on the farms during the planting season. This would be unacceptable to the Commission. On the other hand, if these hearings were to be postponed until the end of June or July, when planting would have been completed, the Commission could not meet the already tight reporting schedule required by the Order-in-Council;

- We believe that an increasing number of people are anxious to present their views in a public forum on the load forecasting process as it applied to determining the electrical load growth in Southwestern Ontario. We know, for instance, that several individuals and organizations have spent a great deal

of time preparing their own submission and their cross-examination of the Ontario Hydro submissions.

Factors which tend to support postponement of the hearings

- The information provided by Ontario Hydro with respect to the requirements for additional bulk power facilities in Southwestern Ontario, and especially the detailed assumptions behind these requirements, have not been presented in sufficient detail.
- Recent Ontario Hydro announcements and press coverage of the declining power growth rates in the province, the high level of excess generating capacity, the lower level of forecasted power requirements, and the "mothballing", or stretch-out, of certain major generating facilities have suggested to the general public that it is quite inappropriate at this time for Ontario Hydro to consider additional bulk power facilities for the period up to 1987 and beyond.

In light of the above conflicting factors, the decision to proceed with the hearings has been a particularly difficult one and quite frankly I have vacillated between a "go" and "no go" position. However, I have concluded that the sooner the Commission can obtain a broad spectrum of views from the public on the forecasting issue, and this is the key issue underlying these hearings, the better.

We look forward to an extremely informative series of hearings and, as usual, we will conduct them in the comparatively informal manner which has characterized all the Commission's hearings, workshops, seminars, etc. to date.

APPENDIX B

OPENING REMARKS

MADE BY MR. BRUCE CAMPBELL

COUNSEL TO ONTARIO HYDRO,

AT THE COMMENCEMENT OF THE SOUTHWESTERN

ONTARIO HEARINGS IN LONDON

ON MARCH 6th, 1979

FOLLOWING DR. ARTHUR PORTER'S

OPENING STATEMENT

Note: The paragraphs typed in italics on page three replace the comments made in London on March 6th regarding the differences between Ontario Hydro's Load Forecasts and the Projections prepared by the Ministry of Energy. The revised comparisons were brought to the Royal Commission's attention at the opening of the hearings in Kitchener on March 13th. A comparison table which is referred to in the amended paragraphs, is appended to these remarks.

Dr. Porter, there are a number of comments which I would like to make in response to your statement. I think the first one is simply the question of the ability to understand the reports on the requirements for additional bulk power facilities in southwestern and eastern Ontario, or the "red reports", as I have grown to call them. Some parts of those documents are indeed difficult to understand and I as Counsel for Ontario Hydro have faced that diffculty as much as anyone. However, I think it is also fair to say that assessing the capability of an electric power system like Ontario Hydro's is inevitably going to be a complex problem by its very nature.

It is always a difficult balance, when dealing with highly technical problems, to settle on exactly how much detail to include. It was therefore decided to include a range of technical details, some of which, particularly the load flow diagrams, are obviously highly technical in nature but are nevertheless important to a proper assessment of the capability of the bulk power system. There was never any expectation that, with the exception of those people who were extremely interested in those matters and were prepared to spend a good deal of time understanding them, that they would be easily and generally grasped.

I would also like to address and add some dimensions to your statement regarding the adequacy of the information provided.

As to the first important determinant you mentioned, population, and as stated in the supplementary information document Ontario Hydro did provide to the Commission, population projections for the study area, broken down by age group, sex and county, were provided to the Commission. I had understood from your staff that these breakdowns were in greater detail than they had been able to obtain and, indeed, some thanks was expressed to Ontario Hydro for this.

I should also point out that Ontario Hydro has made available to your staff a list of all of the data accumulated in the Rates and Utilization Branch with respect to electricity usage. This is undoubtedly the best single collection of data in Canada on electricity usage.

The listing was created in order to be able to better identify additional data requirements as Ontario Hydro continues to develop predictive models which use forecasts of the type of determinants you have mentioned in order to build an overall forecast. Again, your staff indicated that the listing and the information accessible through it would be very helpful.

At the time, therefore, of the preparation of the supplementary information booklet, when we reviewed with the Commission the data which was available, the translation of the original question and how we intended to answer it, I also advised the Commission that certain of its questions about some of those determinants could not be answered with sufficient confidence to make the answers helpful to you. In short, Ontario Hydro was not prepared to develop and put forward projections in which it itself did not have confidence and which it felt would be misleading, nor, I am sure, would you have wanted Ontario Hydro to do so.

Ontario Hydro does feel, however, that the load forecasting process used by it does capture the effects of all major determinants and that it provides high quality operational forecasts well suited to Ontario Hydro's needs.

Both the Select Committee, as stated in the passage you read from their report, and the Ontario Energy Board have felt themselves capable of fairly, and if I may add favourably, assessing both the forecasting process and the forecast produced. I see no lack of capability in the Commission which would prevent it from carrying out the same task.

I would also like to point out that Ontario Hydro has taken steps to supplement the forecasting techniques it employs as suggested by the Select Committee. Larry Higgins, Ontario Hydro's load forecaster, will be mentioning the regional econometric models being developed in Ontario Hydro and, in addition, once experience has been gained in its use it is hoped that the Stanford Research Institute model referred to in the submission and the Ministry of Energy model will also be useful in meeting the Select Committee's suggestions.

If I am permitted to guess, you would likely support this goal of Ontario Hydro's.

The development of such models is not, as you are aware, a short or easy task. The SRI model took in excess of two years to develop, and if I might just add an aside, it was a real scramble to get in a form such that it could be presented to you in these hearings.

The Ministry of Energy model which you referred to has been under development for four years, and as Mr. Rowan, the Deputy Minister of Energy, recently testified before the Select Committee, "I am not suggesting it is complete. It is in its early stage".

The Ministry of Energy staff has also testified that the growth rates for electricity arising out of the model should not be used as a load forecast. I think in this regard, it is important to clarify that over most of the period we feel is critical in assessing the capability of existing and committed facilities, it would appear that the absolute levels of electricity consumption predicted by the Ministry's model are very close to those which have been derived from the 1979 Ontario Hydro load forecast.

For instance, in 1985 the Ministry's prediction of electricity use in Ontario, adjusted for self-generation, is 4 percent lower than an equivalent figure derived from the 1979 Ontario load forecast, a difference well within the range of accuracy of either approach.

I will be filing a table which gives a comparison of forecast levels.

You will note that significant divergence occurs over the 1985 to 2000 period. For the early portion of the period, from 1985 to 1990, the difference between the two approaches is likely less than indicated on the table. This is because the 1990 and 1995 "Total" figures shown for the Ministry of Energy have been derived by applying the average percentage growth over the 1985 to 2000 period to each years growth within the period. In fact what would likely happen would be a gradual tapering off of the percentage increase each year, with the result that the 1990 Ministry of Energy figure would be higher than that shown on the table.

Another factor which you mention as tending to support the holding of the hearings, Dr. Porter, is the attention that has been paid over the last several months to the size of the generation margins on the Ontario Hydro system. Ontario Hydro does, as everyone is aware, have the capability to generate more electricity than is actually required today. And it will have this capability for several years.

It can be no secret, however, that Hydro feels that the existing and committed transmission portion of the total system is becoming inadequate. I cannot emphasize too strongly that it is the <u>total</u> electric power system which Hydro's customers rely on to meet their electrical requirements.

Dr. Porter, to move away from some of the items specifically mentioned in your statement, it is important to recognize that these hearings could not result in a decision to commit and build additional facilities. That decision could not be taken for some considerable time.

In making a decision on your terms of reference, the practical effect, if you do find a need for additional facilities, will be to allow a planning process to commence so that, if the need is still apparent, the option of adding facilities in a timely way is not foreclosed.

The question of what would happen after these hearings, if the Commission finds that additional facilities are needed, was particularly raised by the Foodland Steering Committee, a group established to co-ordinate agricultural concerns in connection with this Commission, but may be of general interest to those attending the hearings.

I believe that there has been sent to you, Dr. Porter, a copy of a letter to me dated February 27th, from Mr. van Donkersgoed, Secretary-Treasurer of the Foodland Steering Committee, setting out the Committee's views on this matter. I have discussed the Foodland Steering Committe's views with Mr. van Donkersgoed and certain other members of the Committee, and set out in my reply to the Committee's letter a process beyond your hearings which Ontario Hydro was prepared to support if it satisfactorily met the concerns set out to me in Mr. van Donkersgoed's letter. I am pleased to say that Mr. van Donkersgoed has confirmed that the approach outlined does meet the concerns expressed, and that in the event that a need for additional facilities is found, he is prepared to try to make it work until such time as our government implements a revised approach in response to this Commission's recommendations.

I have undertaken to advise you of this correspondence by way of filing our exchange of letters. This correspondence outlines the process following these hearings, if your Commission indeed finds a need for additional facilities, in order that those members of the public participating in the hearings might have some clearer idea of the overall context into which we see these hearings fitting.

At this point the correspondence referred to was filed as exhibit SW-3, consisting of the following:

- Letter from Mr. van Donkersgoed of the Foodland Steering Committee to Mr. Campbell, Counsel for Ontario Hydro, dated February 27, 1979.

- Reply from Mr. Campbell to Mr. van Donkersgoed dated March 2, 1979.

- Reply from Mr. van Donkersgoed to Mr. Campbell dated March 3, 1979.

This correspondence is appended to this statement.

I hope this correspondence will provide, to those people who are interested, an adequate understanding of what is expected to follow beyond these hearings.

I think there is only one other announcement I am obliged to make at this time. As we prepared for these hearings we became aware that a study was to be started last month with a view to augmenting local supply to Guelph. This presented a small dilemma. There was some danger that, if advertisements requesting public participation in the Guelph study were placed prior to your southwestern Ontario hearings, there would be some confusion between that study in the local Guelph area and your Commission's hearings, which were expected in that area and throughout southwestern Ontario. It was decided, therefore, when this problem became apparent, that the start of the Guelph study would be delayed.

There will, however, be a local area supply study starting up in the area local to Guelph about the end of March. I wanted to have the opportunity before it started to make it perfectly clear that there is no relationship between the local area supply study and the matters that are being discussed in these hearings.

COMPARISON OF FORECAST LEVELS

	Ontario Hydro Forecast 790212					Ministry of Energy		
	Mw-Yrs	BTUx10^{12}	Ontario Hydro Sales (1)	Other (2)	Final Sales (3)	Final Sales	Self. Gen. (5)	Total
1975 Act. (4)	9,614	287.4	261.3	13.6	274.9	274.2	12.3	286.5
1980	11,603	346.6	315.3	14.3	329.6	328.2	15.1	343.3
1985 (4)	14,493	433.2	393.7	15.0	408.7	392.6	18.9	411.5
1990	18,363	548.8	498.7	15.8	514.5	439.1	20.6	459.7
1995	22,853	683.0	620.6	16.6	637.2	491.1	22.4	513.5
2000 (4)	27,805	831.0	755.0	17.4	772.4	546.3	27.3	573.6
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)

(1) Allows 9.2% for losses +0.3 BTUx10^{12} Ontario Secondary Sales.

(2) Assume to grow at 1%. 1975 value estimated by subtraction Ontario Hydro from (3).

(3) Per "Detailed Energy Supply and Demand 1975" Statistics Canada 57-207

(4) Ministry of Energy's Forecast provided for years indicated. Other years interpolated geometrically. This means an abrupt change in growth in 1986.

(5) Generated for own use by industry.

Note: Comparable figures are shown in cols. (v) and (vi).

Utilization Forecasting
Revised March 9, 1979

FOOD LAND STEERING COMMITTEE

BOX 70, DRAYTON, ONTARIO N0G 1P0 PH. 519-638-3063

February 27, 1979

Mr. Bruce Campbell
Tilley, Carson and Findlay
44 King St. W.
TORONTO, Ontario

Re: SW NEED HEARINGS

Dear Mr. Campbell:

On February 7, 1979 during your cross-examination of my presentation to the Royal Commission on Electric Power Planning I disagreed sharply with some of the views you expressed about the purpose of the SW Need Hearings coming up in March.

In particular I took exception to your statement: *"Now that process has been in abeyance and, ... I just ask you to recognize that all that these reports are intended to address-is the question of whether that planning process ought to continue". (Page 39,906, Line 14 and following, Transcripts, RCEPP, Volume #252, February 7, 1979)*

As I understand the Royal Commission's Need Hearing terms of reference, there is no mandate to consider any kind of planning process. It's key recommendation will be the time at which the bulk power facilities will not be able to supply the load growth in the area. I believe some clarification of Ontario Hydro's views of these hearings and intentions after these hearings are in order. This will avoid a lot of unnecessary confrontation at the March Hearings.

My concern also stems from a letter dated November 23, 1978 from Ken Buller, Community Relations Liaison Officer, Route and Site Selection Division, Ontario Hydro, in which he appears to indicate that the Southwestern Ontario study groups will reconvene just as soon as the Royal Commission makes its Need report.

My position in this matter is as follows:

1. The Royal Commission in its main report is expected to advise on decision making and the planning process. Ontario Hydro should not consider continuing any public planning

.....2

processes in Southwestern Ontario until it has used the Royal Commission's advice to change its internal planning process and to revise its approach to public participation. Further public planning before the Royal Commission tables its main report is unacceptable.

2. At a meeting of the Citizens' Working Groups' Workshop, London, Ontario, August 30 and 31, 1977 the following position was taken by the publics:

> *"..... the majority decided to accept the East System Constraint Map for the purposes of identifying study areas for future transmission route studies in Southwestern Ontario."*

Ontario Hydro's completion of this work will be a significant indicator of Ontario Hydro's ability to use the public input it has already received. I am not prepared to provide further public input until we have an opportunity to evaluate the use made of input already provided.

3. I have no objections to Ontario Hydro continuing various internal planning processes; including the preparation of an environmental impact study for a system or band report based on information the public has provided to date.

4. It would be unwise for Ontario Hydro, as proponent, to seek further public input in Southwestern Ontario before the Royal Commission clarifies the role and responsibilities of proponents.

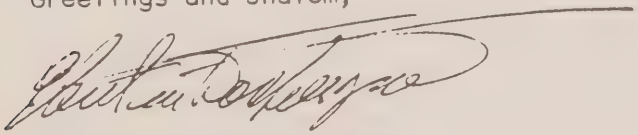
5. Should future proceedings before the Environmental Assessment Board or other Agency be possible in 2 stages (broad bands and site specific); it may be acceptable to seek approval of broad band and system study areas from the Board shortly after the Royal Commission makes its final report. This assumes that Ontario Hydro's position on need will be upheld by the Royal Commission. This could avoid the confrontation that is almost inevitable if Ontario Hydro holds public meetings as a proponent. At the same time I would hope that any such environmental assessment hearing could be an open procedure.

6. I expect that the Royal Commission's need and final reports will have implications for the timing of and the time required for the electric power planning process. Any further public participation activities on the South Western Ontario scale should be postponed until the Royal Commission's findings have been studied.

A clarification from Ontario Hydro during the early part of the SW Need Hearings would be appreciated.

Thank you.

Greetings and Shalom,



Elbert van Donkersgoed
Secretary-Treasurer

EvD:fh

c.c. Arthur Porter, Chairman, RCEPP
Honourable J. Auld, Minister of Energy

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44 KING STREET WEST
TORONTO, CANADA M5H 1G4

March 2, 1979

Mr. Elbert Van Donkersgoed
Secretary-Treasurer
Food Land Steering Committee
Box 70
Drayton, Ontario NOG 1PO

Dear Mr. Van Donkersgoed:

Re: Southwestern Ontario Hearings

Thank you for your letter of February 27, 1979. I agree that the terms of reference for the hearings in March do not require the Royal Commission to consider the planning process relating to any additional facilities which may be required in Southwestern Ontario.

The point of my cross-examination, which took place during your appearance on the public participation and decision making issues, was to point out that a final decision on the requirement for additional facilities is not made until just prior to the commitment of those facilities. For any additional facilities which may be required in Southwestern Ontario, that commitment point has not been reached.

However, as Mr. Taylor indicated in his recent letter to you, Ontario Hydro's forecasts indicate that the bulk power system's existing and committed transmission facilities will become inadequate to serve the requirements of the Southwestern Ontario area in an economic and reliable way. Clearly, therefore, Ontario Hydro has a responsibility to the people of the province to develop plans which would maintain the possibility of meeting those requirements. In this context, Ontario Hydro views the upcoming Royal Commission hearings as a first step which will hopefully permit some progress to be made in initiating planning. This, of course, assumes that the Royal Commission will conclude that the existing and committed system facilities are indeed becoming incapable of serving Southwestern Ontario requirements and that this is sufficient to justify initiating a planning process. As you point out, the terms of reference require the Royal Commission to express their

findings in terms of identifying a date at which additional bulk power facilities, if any, will be needed.

To this point I have been addressing the points raised in the first three paragraphs of your letter. The balance of your letter primarily addresses your Committee's views regarding the planning process which will follow the hearings in Southwestern Ontario. Rather than address each point individually, I have set out a general outline of a process which takes into account those views, and which I believe is responsive to them.

Assuming that the Royal Commission concludes that existing and committed facilities will become inadequate, and as a first step following the issuance at the end of May of the Royal Commission's report arising from the Southwestern Ontario hearings, Ontario Hydro would prepare and submit under the Environmental Assessment Act a system and broad band environmental assessment. As you are aware, this would outline and evaluate alternative system arrangements and alternative broad bands for the location of those system alternatives. This environmental assessment document would be prepared taking into account the public input received to date, including that referred to in point 2 on page 2 of your letter. When filing the document, Ontario Hydro would request a hearing under the Environmental Assessment Act.

Before the environmental assessment document was submitted Ontario Hydro should be prepared to meet with those people who wish an opportunity to discuss with it the implications of the Royal Commission's Southwestern Ontario Report. Following the submission of the document, Ontario Hydro should similarly be prepared to discuss the content of the environmental assessment document with those who wish to engage in such discussions prior to the Environmental Assessment hearing.

When requesting a hearing under the Environmental Assessment Act, Ontario Hydro would probably wish, depending on timing, to request that the hearing commence in early 1980, as would appear to be contemplated in point 5 on page 2 of your letter. Like yourselves, Ontario Hydro is hopeful that the environmental assessment hearing procedures will be open and will encourage a useful dialogue on relevant issues, including those which affect the farm community.

It would also appear that the environmental assessment hearing contemplated could provide a useful forum for discussion of some of the implications of the Royal Commission's final report. For instance, the public participation which would follow the system and broad band hearing and would lead up to the site specific or route stage of the Environmental Assessment Board proceedings might well benefit from such discussion, and perhaps also benefit from some guidance from the Board in this regard. Again, on matters having relevance to the environmental assessment proceedings contemplated, Ontario Hydro would be quite willing to discuss in the hearings the implications of the Royal Commission's final report.

You will recognize that neither your Committee nor Ontario Hydro, nor both together, have the sole responsibility for determining the planning process in relation to any facilities which might be proposed. However, if the approach outlined in this letter satisfactorily meets the concerns set out in your letter to me, Ontario Hydro is prepared support it, at least for the planning process which it expects will be required following the Royal Commission's Southwestern and Eastern Ontario hearings. Having then gone through the process, Ontario Hydro feels, as I am sure your Committee does, that the process itself should be evaluated in light of that experience.

As you wish to have a clarification from Ontario Hydro on these matters during the early part of the Southwestern Ontario hearings, I would appreciate your advising me as soon as possible as to whether the process outlined satisfactorily reflects the views set out in your letter to me.

Yours very truly,

"B.B. CAMPBELL"

LAND STEERING COMMITTEE

J, DRAYTON, ONTARIO N0G 1P0 PH. 519-638-3063

March 3, 1979.

Mr. Bruce Campbell
Tilley, Carson and Findlay
44 King St. W.
Toronto, Ontario

Re: SW Need Hearings

Dear Mr. Campbell:

Your letter of March 2, 1979, indicates a commitment to an approach for a planning process should the Royal Commission on Electric Power Planning indicate that there is a need for additional bulk power facilities.

This letter provides satisfactory clarification of Ontario Hydro's views of these hearings and of Ontario Hydro's intentions after these hearings.

The approach does meet the concerns I have expressed and I am prepared to try to make it work until such time as our government implements a revised approach in response to the Royal Commission on Electric Power Planning's recommendations.

Thank you.

Greetings & Shalom,

Elbert van Donkersgoed
Secretary-Treasurer

APPENDIX C

SW ONTARIO HEARINGS - PARTICIPANTS AND AFFILIATIONS

PARTICIPANT	AFFILIATION
LONDON March 7 - 9, 1979	
David Peterson, MPP	London Centre
Fred Wiesegger	3M Canada Inc.
Tony Furanna	London PUC
John Agnew	University Hospital
M.C. Engels	The Council of the City of London
Robert Baker	Middlesex Federation of Agriculture
John Rousom	Woodstock PUC
John A. Middel	Tillsonburg PUC
Gerry E. Wilson	John Labatt Limited
Andrew Kittmer	Zorra Gravel Pit Owners & Operators Association
Fred Wiesegger	The London Chamber of Commerce
Albert Bannister	Township of London
E.A.N. Ladbrooke	Ministry of the Environment (SW Region)
KITCHENER March 13 - 15, 1979	
Professor E. Farkas	University of Waterloo
W. Boyle	Hydro Electric Commission of Cambridge and North Dumfries
W.E. Thomson	The Regional Municipality of Waterloo
Pierre Delarochelle	Canada Cement Lafarge Limited
John M. Lind	St. Mary's Cement Company
Glen J. Wood	
Karl Dietrich	
Brian Crawley	Wellington Federation of Agriculture
R.C. Wilson	City of Brantford PUC

PARTICIPANT	AFFILIATION
WINGHAM March 19 - 21, 1979	
Tony McQuail	Huron County Federation of Agriculture
R. Christie	CANTDU
Lloyd H. Moore	The Concerned Farmers of the United Townships
Arthur Speer	County of Bruce
Dr. J.K. McGregor	
George Adams	Turnberry-Howick Hydro Corridor Committee
Hilda Echlin	National Farmers' Union District #7
Elbert van Donkersgoed	Food Land Steering Committee
Wayne Peachman	Kincardine & District Chamber of Commerce
Al Lawson	Town of Goderich PUC
Sam MacGregor, Don Haycock	
CHATHAM March 26, 1979	
T. Schuurman	Wallaceburg Hydro Electric System Commission
W. Taves	Kent Federation of Agriculture - Hydro Committee
Dr. S. Wauchop	Union Gas Limited
Ron Roubottom	Simcoe & District Labour Council
SARNIA March 27 - 28, 1979	
R.J. Reynolds	Sarnia Hydro Electric Commission
W.S. Mullin	The Windsor Utilities Commission
Alex J. Munro	Association of Major Power Consumers in Ontario
Joseph P. Zanyk	Dow Chemical of Canada Ltd. Sarnia Division

APPENDIX D

DEVELOPMENT OF BULK POWER SYSTEM - SW ONTARIO

1906, May 6	Passage of "Hydro Bill" in Ontario Legislature
1907, April	First contract placed for purchase of power - from Ontario Power Company.
1908 - 1909	Surveying and purchasing property for high tension lines from Niagara.
1908, Nov. 18	Construction started on first 110 kV line from Niagara.
1909, July 22	First tower erected on 110 kV lines to Western Ontario.
1909	Sites selected for 110 kV transformer stations at Niagara Falls, Dundas, Toronto, Woodstock, London, Guelph, Preston, Berlin (Kitchener), Stratford, St. Mary's and St. Thomas.
1910, Oct. 11	First power supplied at 110 kV switched on in Berlin.
	Dates of connecting other municipalities:
Nov. 13	Guelph and Waterloo
December	Preston, Woodstock, London, Hamilton, Stratford
1911, January	Dundas and Hespeler
February	New Hamburg and St. Thomas
March	Galt and Toronto
April	Ingersoll and St. Mary's
1914, August	110 kV transmission extended to Windsor. (274 miles of 110 kV now in service)
	Brantford also supplied in this year.
1917	Construction of Queenston - Chippawa G.S. started.
1910 - 1920	Transmission lines increased from 523 to 3,332 circuit miles.
1921, Dec. 29	Queenston - Chippawa G.S. in service.
1920 - 1945	Continued expansion of 110 kV system.

1947 - 1948	New 110 kV transformer stations placed in service at Wallaceburg, Kingsville, Scarborough and Owen Sound.
1948, Nov. 1	Buchanan Frequency Changer #2 in service (London).
1948 - 1949	230 kV steel tower line in service between Allanburg (Niagara) and Westminster (London).
	New 110 kV wood pole line in service from Sarnia to Westminster (London).
1949, Jan. 3	First emergency steam generating station placed in service. Several located at Hamilton, Thorold, Scarborough, Chatham, etc. Provided up to 60 MW in 1950, but little used thereafter.
Mar. 29	Buchanan F/C #1 in service.
May 18	Frequency conversion of customers loads commenced.
July 4	First Des Joachims Unit in service.
1950, Sept. 22	Buchanan F/C #3 in service.
1950	New 230 kV, 60 Hz, steel tower circuits in service:
	1 Minden - Buchanan T.S. (London)
	1 Minden - Burlington
	1 Burlington - Manby (Toronto - Kipling Ave.)
	1 Burlington - Buchanan T.S. (London)
	New transformer capacity at many locations.
1951, Oct. 27	Hearn G.S. Unit #1 in service
Nov. 8	J. Clark Keith G.S. (Windsor) #2 Unit in service.
1951	Transmission line additions:
	230 kV, 60 Hz — 1 Minden - Essa
	115 kV, 60 Hz — 1 Devizes - Seaforth
	1 Buchanan - Kent
	1 Burlington - Kitchener
	1 J. Clark Keith - Essex
	1 Owen Sound - Hanover
	New transformer capacity at many locations.

1952, Apr. 1	J. Clark Keith G.S. #1 Unit in service	
1952	Transmission line additions:	
	230 kV	1 Essa - Buchanan
		1 Buchanan - J.C. Keith (i/s at 115 kV)
	115 kV	1 Kitchener - Stratford
		1 J.C. Keith - Essex
	New transformer capacity at many locations.	
1953, Jan. 25	230 kV, 60 Hz line in service from Buchanan - (London) to J.C. Keith (Windsor) completing the 230 kV network across the province from the Ottawa River to Windsor.	
Apr. 12	J. Clark Keith G.S. #3 Unit in service.	
July	Detweiler T.S. (Kitchener) in service at 230 kV.	
Sept. 3	Detroit Edison - J.C. Keith interconnection in service.	
Sept. 14	Detroit Edison - Sarnia T.S. interconnection i/s.	
1954, Apr. 26	First unit of Beck G.S. #2 in service.	
July 1	Interconnection agreement between Ontario Hydro and Niagara Mohawk for mutual assistance and economic interchange became effective.	
Oct. 9	J.C. Keith Unit #4 in service.	
1954	Several more new 230 kV and 115 kV transmission lines placed in service in S.W. Ontario.	
1958, July 5	First Unit of Saunders G.S. in service.	
1959, July 9	Frequency standardization programme completed.	
1967	Douglas Point in service.	
1969	Lambton commences operation.	
1972	Nanticoke commences operation.	
1976	Bruce G.S. A commences operation.	

Public Hearings Department
April 4, 1979

APPENDIX E

Ontario

Royal Commission
on Electric Power
Planning

416/965-2111

7th Floor
14 Carlton Street
Toronto Ontario
M5B 1K5

January 4th, 1979

Mr. Malcolm Rowan
Deputy Minister
Ministry of Energy
Queen's Park
Toronto, Ontario

Dear Mr. Rowan:

Order-in-Council No. 2065/78, dated the 12th of July, 1978, requires the Commission, in Paragraphs 4(A)(i) and (ii), to consider and report on the load growth and the capability of existing and committed bulk power generation and transmission facilities to supply this load to the east and west areas, and the Commission is currently planning to complete the hearings with respect to these studies in March and April.

It is noted that the Order-in-Council requires the Commission to take "into account government policy with respect to the use of inter-connections with neighboring utilities".

In order, therefore, that the Commission may have a clear understanding of government policy with respect to the use of inter-connections with neighboring utilities, it would be appreciated if the Commission could receive, through you, a statement of this policy so that there would be no misunderstanding with respect thereto, and that the Commission would have a clear understanding of that which they must take into account in carrying out the requirements of the Order-in-Council.

Yours very truly,

Frederick R. Hume Q.C.
Commission Counsel.

FRH/mta

Ontario

Office of the
Deputy Minister

Ministry of
Energy

Telex
Enrgy Tor
06-217-880

Queen's Park
Toronto Ontario

February 27, 1979

Frederick R. Hume, Q.C. Esq.
Commission Counsel
Royal Commission on
Electric Power Planning
7th Floor,
14 Carlton Street
Toronto, Ontario
M5B 1K5

Dear Mr. Hume:

In response to your request of January 4, 1979 for a statement of government policy with respect to the use of interconnections with neighbouring utilities, I should state that this policy encompasses:

1) support for the fullest use, as technically and economically justified, to be made by Ontario Hydro of its power system's existing interconnections with neighbouring utilities in Canada and the United States.

   The above policy is reflected in the government's acceptance of recommendation III-21 in the June 1976 report by the Select Committee inquiring into Hydro's proposed Bulk Power Rates. A copy of the government's response is attached.

2) support for the strengthening, as technically and economically justified, of Ontario Hydro's power system interconnections with neighbouring utilities in Canada and the United States, so that increased use of them in the future will be possible, for all forms of interchange of power, including firm power contracts, as approved by the government.

..2/

The Government has requested Ontario Hydro to explore the possibility of marketing surplus power, on either an interruptible or a firm basis, to other Canadian and American utilities, consistent with the needs of and benefits to Ontario power consumers. Interconnections and associated transmission within Ontario must be accorded a high priority in successfully marketing surplus power. Extracts from the statement made by the Minister of Energy to the Legislature on April 17, 1978, concerning Ontario Hydro's construction program 1978-1987, are enclosed. I should also refer you to the Hansard record of the Minister's statements before the Select Committee on Hydro Affairs on August 16, 1978, a copy of which will be in your Commission's library.

I should add that the Government, ever since 1973, has expressed support for achieving greater utilization of Canada's power generation resources through regional power grids. This support is evident from the positions taken by the Government of Ontario at First Ministers' Conferences (1974 to date), as well as from the support given by the Ministry of Energy and Ontario Hydro to the recent studies of East-West and of North-South exchanges of power. A copy of the report on the East-West study sponsored by the Interprovincial Advisory Council on Energy, was made available to your Commission's library. A final report on the U.S.-Canada power exchange study is expected to be available by late March, and a copy will be sent to your library.

By the way of final comment, I should say that the Government supports the concept of having a reasonable value placed upon Ontario Hydro's interconnections with other power systems in Canada and the U.S., a value which can be quantified in the context of the required system reserve margin for Ontario Hydro.

I am enclosing for your information a copy of a letter dated February 22, 1979, from the Minister of Energy to the Chairman of the Select Committee on Ontario Hydro Affairs, with respect to Government policy on the export of electric power by Ontario Hydro.

Yours sincerely,

Malcolm Rowan

Malcolm Rowan

c.c. The Honourable James A.C. Auld

Ontario

Office of the Minister

Ministry of Energy

416/965-4286
Telex
Enrgy Tor
06-217-880

Queen's Park
Toronto, Ontario

February 22, 1979

Mr. D.C. MacDonald
Chairman
Select Committee on Hydro Affairs,
Room 212
Legislative Building N.W.,
Queen's Park
Toronto, Ontario

Dear Mr. MacDonald:

In your letter of February 14, 1979, you requested a statement of current Government policy in relation to the export of electric power by Ontario Hydro. You also requested an explanation of any Government policy changes affecting the export of electric power that have been implemented during the past three years, or that are contemplated within the next two years.

Before answering your requests, it may be useful to provide you with some background information.

Ontario Hydro is not prohibited under The Power Corporation Act from exporting electric power. However, if it wishes to export electric power, Ontario Hydro first obtains the approval of the Lieutenant Governor-in-Council under section 70 of The Power Corporation Act and a licence from the National Energy Board under sections 81 to 83 of the National Energy Board Act.

Ontario Hydro has exported large quantities of electric power over the years with the approval of the Lieutenant Governor-in-Council and the National Energy Board. For example, the gross revenues from Ontario Hydro's exports of electric power in 1978 amounted to approximately $285-million. The net revenues from such sales are used to offset the revenue requirements of Ontario Hydro thereby benefitting the Ontario electrical consumer.

.../2.

Ontario Hydro's export sales of electric power to date have been made under inter-connection agreements which Ontario Hydro has with utilities in New York and Michigan. Among other things, the inter-connection agreements provide a mechanism for Ontario Hydro to export electric power produced from its unused reserve generating capacity. Ontario Hydro may interrupt the flow of electric power being sold by it under the inter-connection agreements at any time if it or any other Canadian utility requires the electric power.

The Government's basic policy is to approve the export of electric power by Ontario Hydro where the quantities proposed for export are surplus to Ontario and Canadian needs.

Following Ontario Hydro's significantly reduced 1978 load forecast, it became apparent that Ontario Hydro would likely have more generating capacity available in the early to mid-1980s than it would require to meet its forecast demand with an adequate margin of reserve. Accordingly, the Cabinet requested Ontario Hydro to explore the possibility of marketing, on either an interruptible or a firm basis, the electric power which could be produced from this surplus generating capacity. Following receipt of this request, Ontario Hydro initiated discussions with other Canadian and American utilities. These discussions have been exploratory only and Ontario Hydro has not presented a contract proposal to the Government for its approval.

Given the changed circumstances arising out of Ontario Hydro's significantly reduced 1978 and 1979 load forecasts, the Government will look positively at all proposals presented to it by Ontario Hydro for the export of electric power, including proposals for firm exports, which promise to provide a benefit to the Ontario electrical consumer. In reviewing such proposals, the Government will, of course, take into account the broader effects on Ontario of the proposed exports. It is premature to say on what terms and conditions the Government would approve a proposal by Ontario Hydro for the firm export of electric power.

.../3.

The basic policy of the Government with respect to the export of electric power has not changed and is not expected to change. Exports will be undertaken only if foreseeable Ontario and Canadian needs are secure.

Yours sincerely,

James A.C. Auld

EXTRACT FROM

STATEMENT TO THE LEGISLATURE

by

HON. REUBEN BAETZ, LL.D.

MINISTER OF ENERGY

on

ONTARIO HYDRO'S CONSTRUCTION PROGRAM 1978 - 1987

APRIL 17, 1978

In addition, the Government is requesting Ontario Hydro to begin negotiations with other Canadian and U.S. jurisdictions to develop potential export markets in order to capitalize on the remaining surplus capacity which will result from this revised generation program, particularly during the period 1981-85.

While our policy not to build generating capacity solely for export markets has not changed, I hardly need to remind the Members of this House, Mr. Speaker, that Hydro earned about $200 million gross revenue from the export of electric power in 1977 resulting in a benefit to electrical consumers through reduced electric power bills in 1977 and 1978.

This modification to Ontario Hydro's construction program reflects the realities we face in these uncertain times -- realities of reduced demand, lower economic growth, and related higher unemployment. It reflects the need for Ontario Hydro to maintain a diversified fuel capability and a production flexibility in anticipation of an improving economic climate.

Most of all, this modification reflects the confidence this Government has in the future of this Province and the strength which we have gained in the past from having abundant and relatively inexpensive electrical energy.

Recommendation

III-21 ONTARIO HYDRO ASSIGN A REASONABLE VALUE TO THE INTERCONNECTION SYSTEM IN PLANNING THE NEW GENERATION REQUIRED TO MEET THE RELIABILITY STANDARD.

RESPONSE - ACCEPTED

Recommendation

III-22 ONTARIO HYDRO CHANGE ITS PLANNING PROCESS TO EMPHASIZE MEETING ONTARIO'S ELECTRICAL ENERGY NEEDS AFTER IMPLEMENTATION OF CONSERVATION AND LOAD MANAGEMENT PROGRAMS, WITH THE MINIMUM AMOUNT OF NEW GENERATION THAT IS CONSISTENT WITH SOUND PLANNING.

RESPONSE - ACCEPTED

The Minister of Energy has directed Ontario Hydro to emphasize in its planning process the meeting of Ontario's electrical energy needs after implementation of conservation and load management programs have been taken into account.

Recommendation

III-23 ONTARIO HYDRO ACCEPT THE COMMITTEE'S EARLIER RECOMMENDATIONS AND FURTHER REDUCE ITS TARGETS FOR ADDING GENERATION IN THE NEXT TEN YEARS.

RESPONSE - REJECTED

In January 1976, Ontario Hydro was directed by the Government to limit its demands on the capital markets for 1976, 1977 and 1978 to $1.5 billion a year. This resulted in Ontario Hydro deferring its system expansion program and means that Hydro will limit its system expansion rate to 6% versus an historic growth in electrical demand of 7%.

NOTES

Section	Note	
I	1.	The reporting date was subsequently extended to June 14, 1979.
II	1.	See "A Race Against Time", Interim Report on Nuclear Power, Royal Commission on Electric Power Planning, Chapter 4, September 1978.
III	1.	See Section IX for details of these measures.
III	2.	Ontario Hydro Exhibit SW-4, "Bulk Power Facilities SW Ontario", p. 4.
III	3.	*Ibid.*, p. 2.
V	1.	At present, the Load Forecasting Unit is comparatively small (four full-time members). Further, it is oriented towards economics, mathematics, and engineering. The question arises, what about other disciplines, especially in the social sciences, to facilitate identification of life-style changes, etc.?
V	2.	Select Committee of the Legislature Investigating Ontario Hydro, "A New Public Policy Direction for Ontario Hydro", June 1976, p. III-6.
V	3.	Ontario Hydro memorandum to the Royal Commission on Electric Power Planning, "Load Forecasting", Public Information Hearings, May 1976, p. 35.
V	4.	This model was developed by SRI International at the request of the Canadian Electrical Association.
V	5.	These will be published as supporting documents to our Final Report later this year (1979).
V	6.	In Ontario Hydro Exhibit SW-39, submission to the Select Committee on Hydro Affairs, February 28, 1979, it is stated:

> In the new models, the price of oil has been included, and is statistically significant. It is interesting that its coefficient is negative, which says that an increase in the price of oil tends to reduce electrical demand in Ontario.

(cont'd)

Section	Note	
V	6. (cont'd)	Ontario Hydro's chief load forecaster, Larrett Higgins' explanation of this anomalous finding was that: It is probable that increases in world oil prices exert downward pressure upon the general economic activity and that the multiple regression technique is in part capturing such an effect.
VII	1.	It may also exceed the power carrying capability of the transmission network.
VIII	1.	The bulk power transmission system enables the distribution stations to be supplied from the generating stations in various ways, providing enhanced flexibility, reliability, and economy of power supply.
VIII	2.	The reliability of all complex biological and technological systems is predicated largely on "built-in redundancy". The central nervous system of the human body is an excellent example.
VIII	3.	There are other methods of improving transient stability, notably the reduction of the reactance of transmission lines and the use of shunt reactive-power compensation.
IX	1.	It is important to note that, since the November 1965 major black-out, the interconnections between Ontario and New York have been controlled, in effect, by highly sensitive relays (the CAW relays) that trip in the event of a power overload that lasts for 10 seconds, thereby protecting the U.S. networks.
IX	2.	Note the distinction between the "critical area" load and the "total region" load. For example, in 1978 the critical area load and the total region load were about 2,500 MW and 3,500 MW, respectively. The distinction is important in considering the capability of the bulk power lines and does not apply to generation.
IX	3.	See Ontario Hydro Exhibit SW-6, p. 18.
X	1.	It is important to note that the security of operation of both Bruce A and Bruce B will only be assured when a second 500 kV line out of Bruce is in place. The existing double-circuit 500 kV line (Bruce to Milton), when in service, will be subject to sudden outages,

Section	Note	
X	1. (cont'd)	due, for example, to lightning strikes, with the consequent high probability of both load rejection and generation rejection.
X	2.	At present the still incomplete double circuit 500 kV line out of Bruce to Milton TS is being operated at 230 kV as far as Belwood Junction.
X	3.	See Ontario Hydro "1979 Review of Generation Expansion Program", March, 1979, Section 5.
X	4.	The comparative environmental impacts of coal and nuclear generation would have to be weighed also; we address this topic in the Final Report.
XI	1.	Ontario Hydro, Exhibit SW-4, "Bulk Power Facilities SW Ontario", December, 1978, p. 19.

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